1990 WESTFIELD RIVER SURVEY

WATER QUALITY DATA
WASTEWATER DISCHARGE DATA
WATER QUALITY ANALYSIS

MASSACHUSETTS DEPARTMENT OF ENVIRONMENTAL PROTECTION
DIVISION OF WATER POLLUTION CONTROL
TECHNICAL SERVICES BRANCH

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Prepared By

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Regional Planner

MASSACHUSETTS DEPARTMENT OF ENVIRONMENTAL PROTECTION
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TECHNICAL SERVICES BRANCH
WESTBOROUGH, MASSACHUSETTS

JULY 1991

TITLE:	1990 Westfield River Survey Water Quality, Wastewater Discharge Data and Water Quality Analysis
DATE:	July 1991
AUTHOR:	William J. Dunn, Jr., Regional Planner

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ABSTRACT

Water quality data were collected from eleven (11) stations along the Westfield River and parts of four (4) tributaries during the Summer of 1990. Surveys were conducted on June 27, August 8, and September 19. The sampling runs were conducted on each of those days beginning at 8:30 a.m. (in Huntington), and ending at 1:00 p.m. near the confluence of the Westfield and the Connecticut River. Samples were collected at two stations for Microtox™ analysis, and at all eleven stations for dissolved oxygen, fecal coliform bacteria, pH, biochemical oxygen demand, total alkalinity, suspended solids, hardness, total Kjeldahl-nitrogen, ammonia-nitrogen, nitrate-nitrogen and total phosphorus. Six stations were tested for metals: aluminum, chromium, copper, nickel, iron, lead, zinc, and silver. Samples were collected at each station for dissolved oxygen and pH, and at three of the stations for chlorophyll a and phytoplankton counts. Additionally, four (4) dischargers were sampled (same parameters as above): three (3) WWTP's (Huntington, Russell, Westfield), and one industry (Strathmore Paper Co.).

In addition to the three survey runs, there were two special survey runs conducted on July 7, and October 10. These specifically were to take additional Microtox™ and metals samples in the Little River, and Westfield City area river segments. One of the Microtox™ samples, taken on June 27 near downtown Westfield, was analyzed as extremely toxic, so these other surveys were conducted to verify the June 27 data. Also, on October 9, five (5) dischargers were sampled again: the four mentioned above, plus the Columbia Manufacturing Company discharge.

INTRODUCTION

This report presents the compilation of field and laboratory data collected during summer of 1990 from eleven stations, and five NPDES dischargers along the Westfield River and parts of four tributaries (Tables 1, 2; Figures 2, 3). Surveys were conducted on June 27, August 8, and September 19, 1990, with 2 other special surveys conducted on July 7 and October 9, 1990. Water samples at the stations were taken on a grab basis, while NPDES discharge samples were generally taken on a 24-hour composite basis. Additionally, fish tissue samples were taken in mid-October, 1990 in at least five upstream areas of the Westfield and its three main tributaries.

The DWPC has conducted surveys, and subsequently published data reports on the Westfield River, in these prior years: 1966, 1971, 1972, 1974, 1975, 1977, 1980, 1983 and 1985[1]. The last survey was conducted in 1985. Samples for 24 stations and six (6) dischargers were collected for dissolved oxygen, chemical analysis, total and fecal coliform bacteria. The water quality data collected by the Division during May and July of 1985 demonstrated good water quality in much of the basin. Most water quality problems were in the lower portions of the Westfield River, where the watershed is predominantly urban. However, water quality in the lower portion of the river has improved greatly compared to conditions which existed in the 1950's through the mid-1970's.

Segments generally met their classification standards, except for the two lower Westfield River segments (near the Connecticut River). These two segments have a number of industrial and municipal dischargers, plus the problem of significant loadings of pollutants from stormwater runoff, and combined sewer discharges. These lower portions of the river have a smaller assimilative capacity than the upper reaches, in that the slope is much flatter, and the river moves slower, resulting in lower reaeration rates. Bacteria concentrations increasingly became higher in the two segments of the lower Westfield River. Increasingly, Class B standards for fecal coliform (200/org. per 100 ml) were violated as one moved down the lower portion. Also, the Little River segment had high fecal coliform counts (in violation of B standards).

The 1990 summer survey was to be synoptic in character, to monitor the ambient water quality along the Westfield and its tributaries at eleven selected stations. The stations are listed in Table 1, and located in Figure 1 (Westfield Basin map with 1990 station locations). DWPC budget constraints, and lack of normal summer staffing assistance for monitoring, necessitated the shortening of the normal survey to include a more selective monitoring.

The survey began on each of the days at 8:30 a.m. at station <u>WF08</u> (see location descriptions on Figure 1) and then followed on to stations <u>WF10</u> , <u>WF12</u>, <u>WF14</u>, WF19, <u>WF20</u>, <u>WF21</u>, <u>WF22</u>, <u>WF23</u>, <u>WF24</u>, and ended at station <u>WF25</u>, near the confluence of the Westfield and Connecticut Rivers, (approximately finishing 12-12:30 p.m.). Stations were selected based on their proximity to either a tributary mouth or downstream from a particular discharge or combined sewer overflow.

Parameters that were sampled at all eleven stations included: <u>chemical</u>, <u>nutrient</u>, <u>bacteria</u>, and <u>dissolved oxygen</u>. Additionally, other parameters that were selectively sampled included <u>algae</u> <u>chlorophyll</u>, <u>metals</u>, <u>Microtox™</u>, and <u>organics</u> (VOA's) at stations <u>WF12</u>, <u>WF22</u>, and <u>WF25</u>. Temperature and sample water pH were measured in the field at each station on each of the three dates.

At the conclusion of each survey (station WF25) all samples for chemical, nutrient, bacteria, metals and organics were immediately put on ice and delivered to the Lawrence Experiment Station for analysis (according to standard operating procedures). Dissolved oxygen samples were returned to TSB for analysis, via the accepted modified Winkler laboratory procedure. Additionally, algae-chlorophyll, and Microtox™ samples were taken to TSB for appropriate lab analysis by appropriate staff.

FIGURE 1

WATER QUALITY CLASSIFICATION

WESTFIELD RIVER BASIN

Separately, on the three (3) survey dates, four 24-hour composite effluent samples were collected by internal treatment plant staff, at three (3) municipal wastewater treatment facilities, and one (1) manufacturing facility (Strathmore Paper Co.). Regular TSB survey staff picked these up and delivered them to the Lawrence Experiment Station on the scheduled survey dates as agreed to, prearranged times. Composite samples for chemical, nutrient, bacteria, metals were collected, and a grab sample for DO was collected on the survey data. An ISCO sampler was set up if the treatment plant could not provide a composite sample. Each sample (water and effluent) was analyzed for the following parameters: DO, pH, 5-day BOD, SS, Cl, Alk, TKN, NH_3N, NO_3N, TP, selective metals, and fecal coliform bacteria.

There were 2 additional special surveys conducted on July 7, and October 9. These were to take extra Microtox™ and metals samples in the Little River and Westfield city area river segments. Included in the sampling was Columbia Manufacturing Company and the five dischargers as listed in Table 2, and located on the locator map (Figure 3).

The data was analyzed for purposes of updating the 1985 Water Quality/Wastewater Discharge Data Report. Of particular significance, was to determine if the(several) construction grant projects e.g., Huntington Wastewater Treatment Plant, Westfield Sewer System Rehabilitation Project, Agawam CSO study and projects, have had any positive effect in lowering bacteria counts throughout the entire lower portion of the Westfield River below the confluence of the west branch with the main river stem. Flow measurements were taken at 3 USGS gages (1): Huntington on west branch, Fiske Avenue, one mile upstream of station WF08; (2) Huntington on east branch, two and one-half miles upstream of station WF07 Route #112; (3) Westfield on main branch, one mile downstream of station WF21 on Route #20. The USGS has automatic recording flow gages at these sites. The USGS office in Springfield was contacted for automatic flow information on survey dates.

FIGURE 2
LOCATION OF SAMPLING STATIONS
Westfield River 1990 Survey
SAMPLING STATION
Basin Location Map
Savoy
Hawley
Windsor
Plainfield
Ashfield
WESTFIELD R.
Cummington
Goshen
Peru
MIDDLE BRANCH
EAST BRANCH
Worthington
Chesterfield
Washington
Middlefield
WEST BRANCH
Becket
Chester
Huntington
N
0
5mi
0
5km
8
Otis
Blandford
10
Montgomery
12
14
Holyoke
Russell
COBBLE MOUNTAIN RES.
LITTLE R.
Westfield
20
22
West Springfield
19
23
25
Tolland
GRANVILLE RES.
Granville
Agawam
Southwick
CONNECTICUT R.
WESTFIELD RIVER BASIN

WESTFIELD RIVER BASIN

Figure 3

LOCATION OF WASTEWATER DISCHARGES

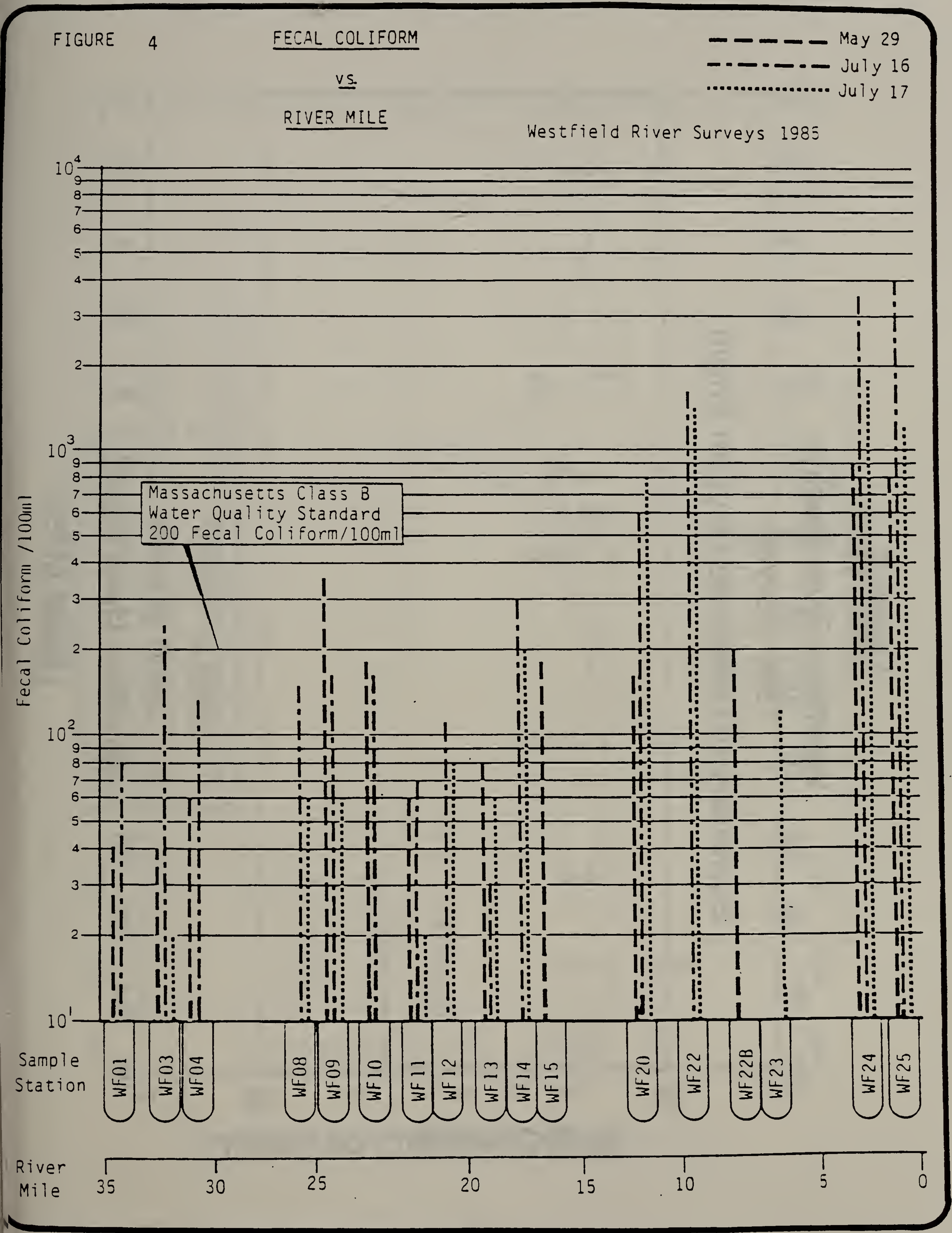


FIGURE 4
FECAL COLIFORM
vs.
RIVER MILE
May 29
July 16
July 17
Westfield River Surveys 1985
Fecal Coliform /100ml
Massachusetts Class B
Water Quality Standard
200 Fecal Coliform/100ml
Sample
Station
WF01
WF03
WF04
WF08
WF09
WF10
WF11
WF12
WF13
WF14
WF15
WF20
WF22
WF22B
WF23
WF24
WF25
River
Mile
35
30
25
20
15
10
5
0

Figure 5

Westfield River Basin
1990 Survey
Summary of Dissolved Oxygen (mg/l)

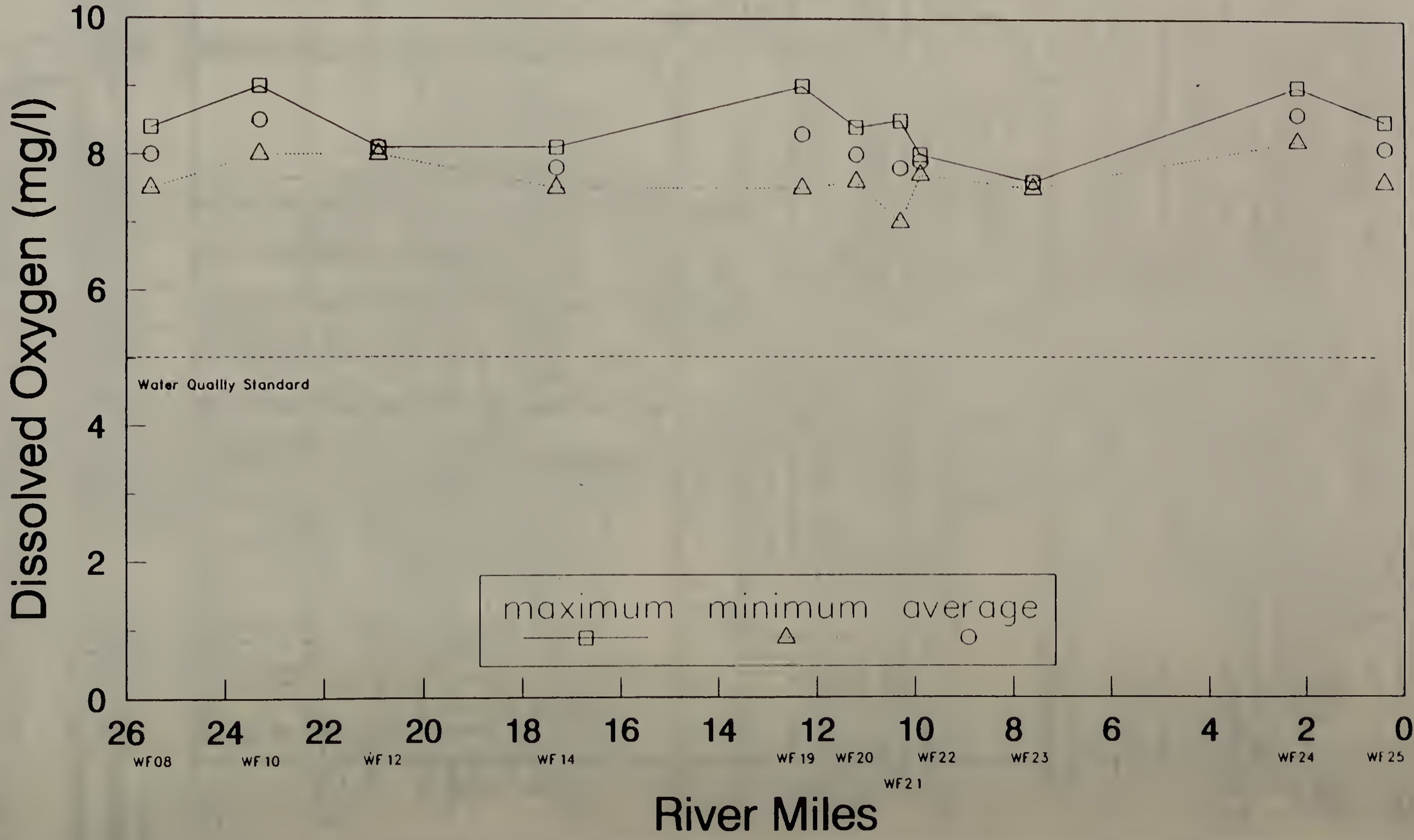
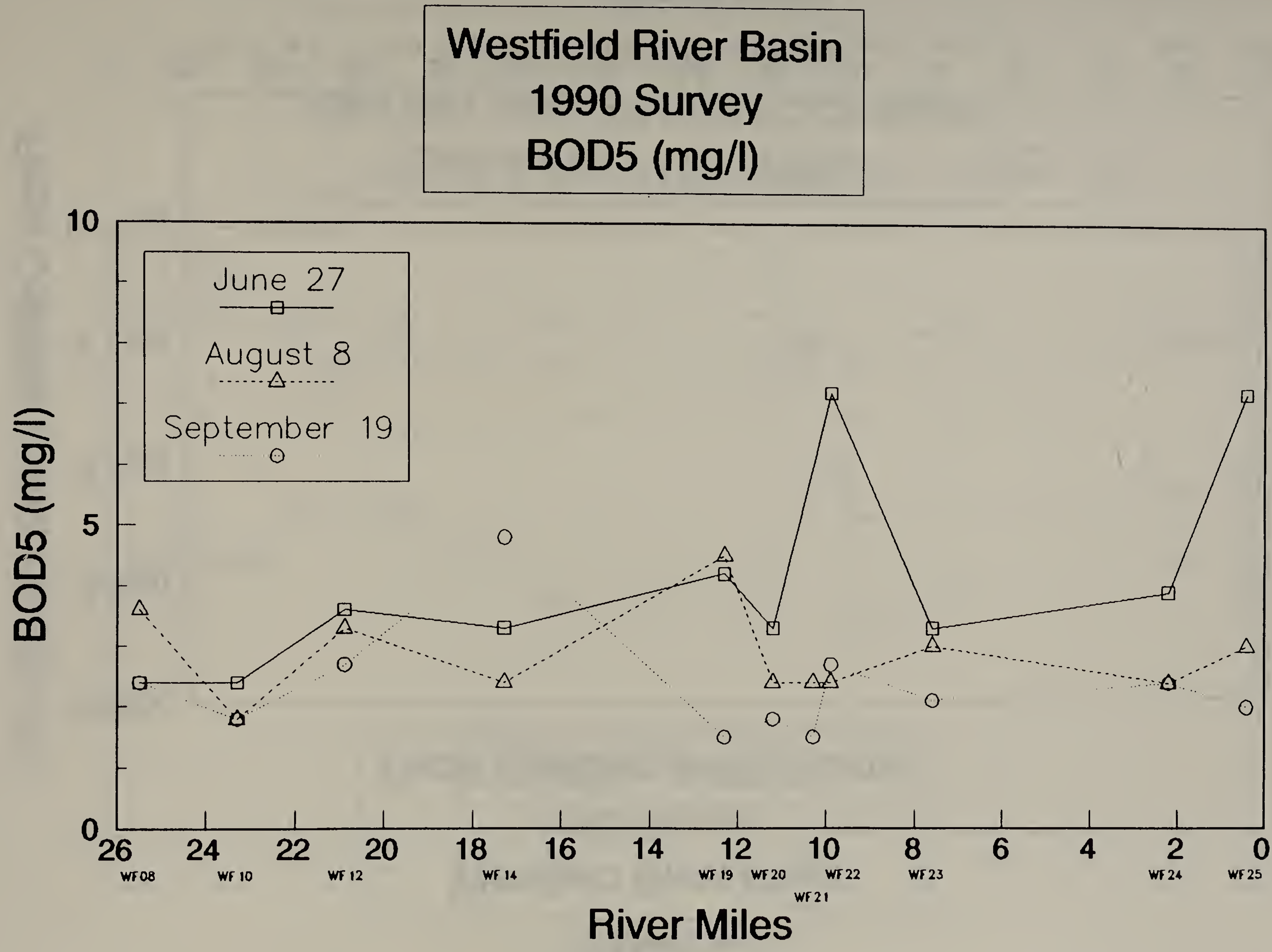


Figure 6



Westfield River Basin
1990 Survey
BOD5 (mg/l)
June 27
August 8
September 19
BOD5 (mg/l)
10
5
0
26
24
22
20
18
16
14
12
10
8
6
4
2
0
WF08
WF 10
WF 12
WF 14
WF 19
WF 20
WF 21
WF 22
WF 23
WF 24
WF 25
River Miles

Figure 7

Westfield River Basin
1990 Survey
Fecal Coliform (MPN/100ml)

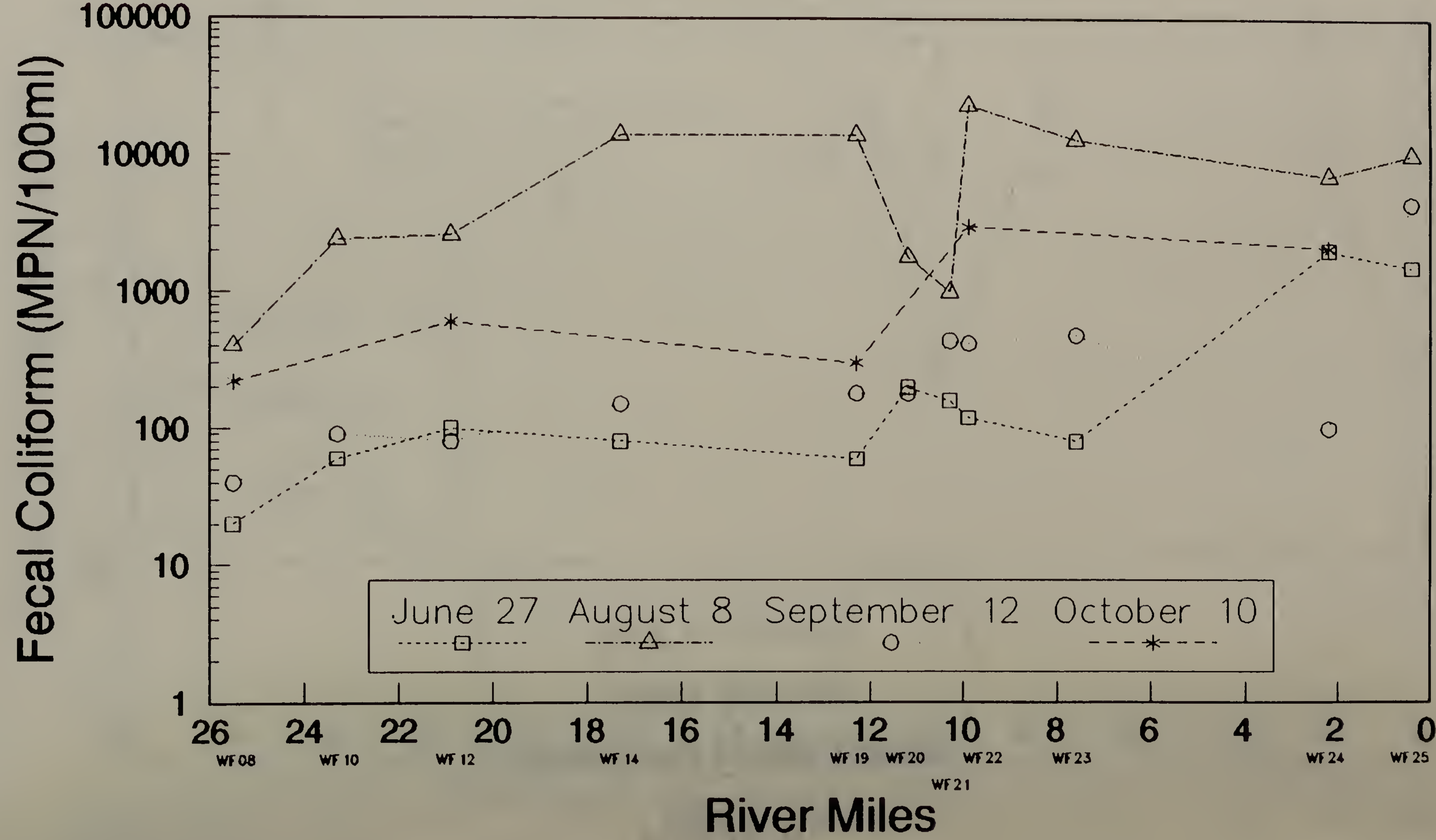


Figure 8

Westfield River Basin
1985 and 1990 Surveys Comparison
Dissolved Oxygen (mg/l)

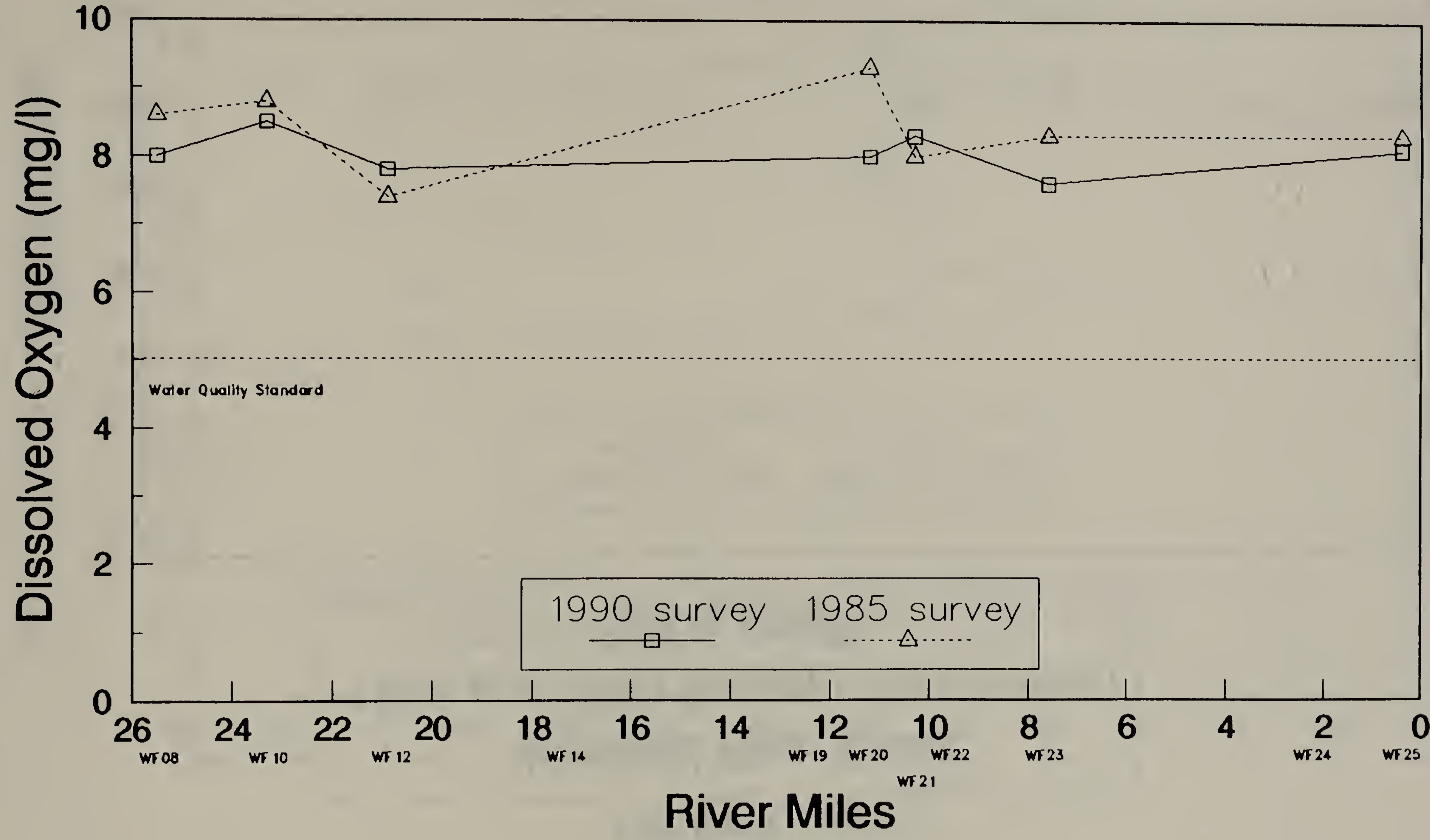


Figure 9

Westfield River Basin
1985 and 1990 Surveys Comparison
BOD5 (mg/l)

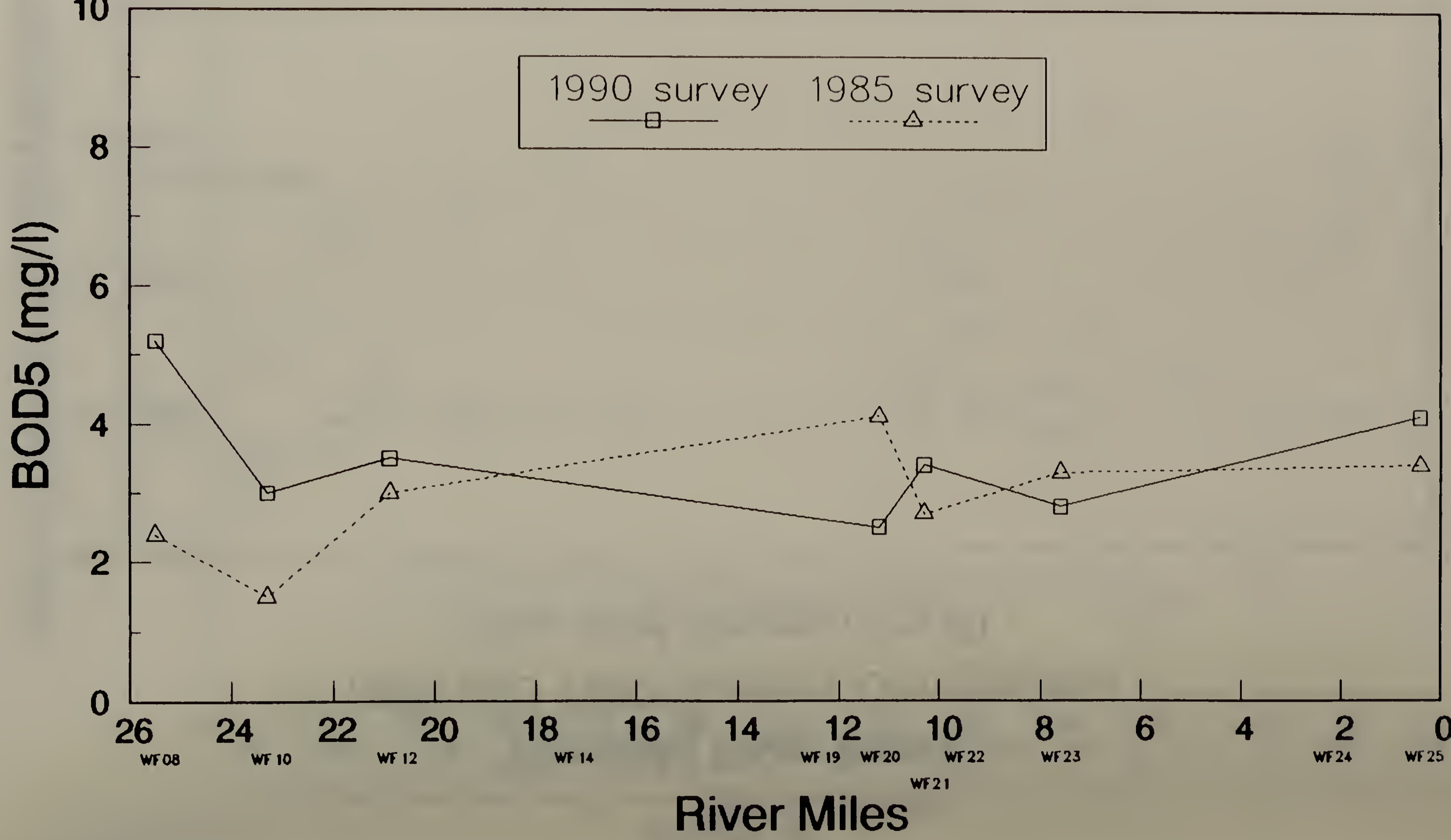
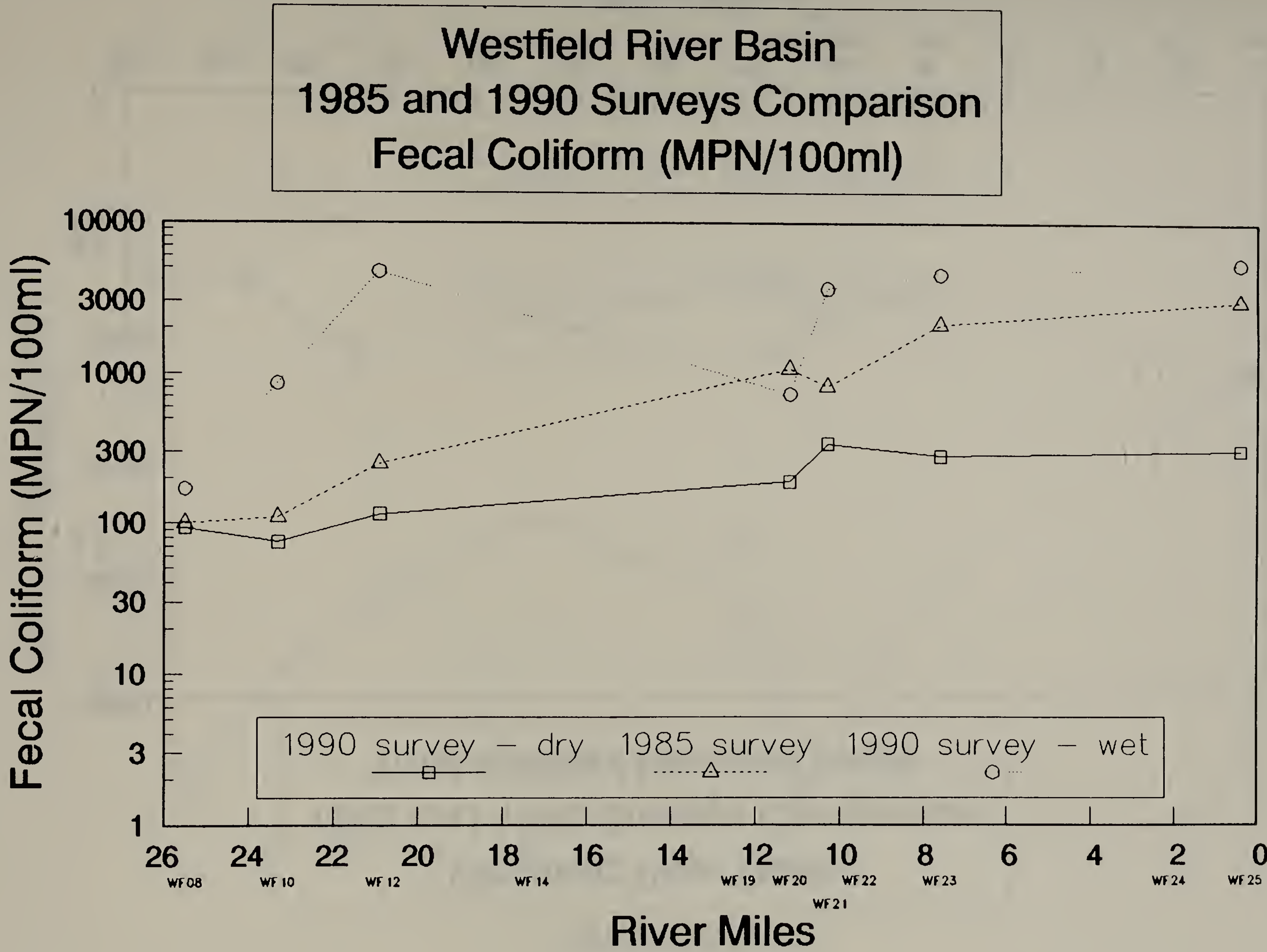


Figure 10



Westfield River Basin
1985 and 1990 Surveys Comparison
Fecal Coliform (MPN/100ml)
Fecal Coliform (MPN/100ml)
10000
3000
1000
300
100
30
10
3
1
1990 survey - dry
1985 survey
1990 survey - wet
26
24
22
20
18
16
14
12
10
8
6
4
2
0
WF08
WF10
WF12
WF14
WF19
WF20
WF22
WF21
WF23
WF24
WF25
River Miles

Figure 11

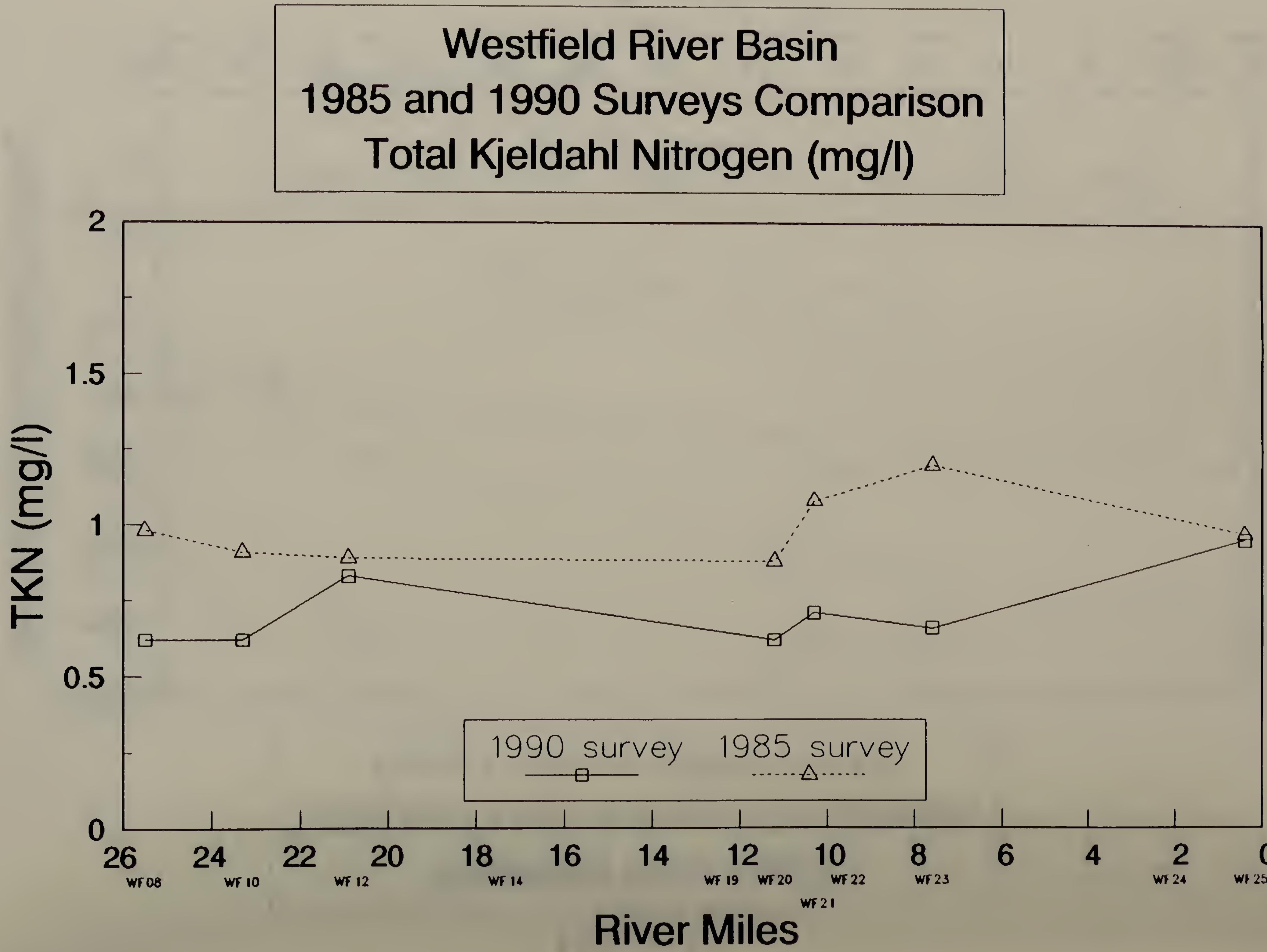

Westfield River Basin
1985 and 1990 Surveys Comparison
Total Kjeldahl Nitrogen (mg/l)
TKN (mg/l)
2
1.5
1
0.5
0
26
24
22
20
18
16
14
12
10
8
6
4
2
0
WF 08
WF 10
WF 12
WF 14
WF 19
WF 20
WF 21
WF 22
WF 23
WF 24
WF 25
River Miles
1990 survey
1985 survey

Figure 12

Westfield River Basin
1985 and 1990 Surveys Comparison
BOD5 Loadings (lbs/day)

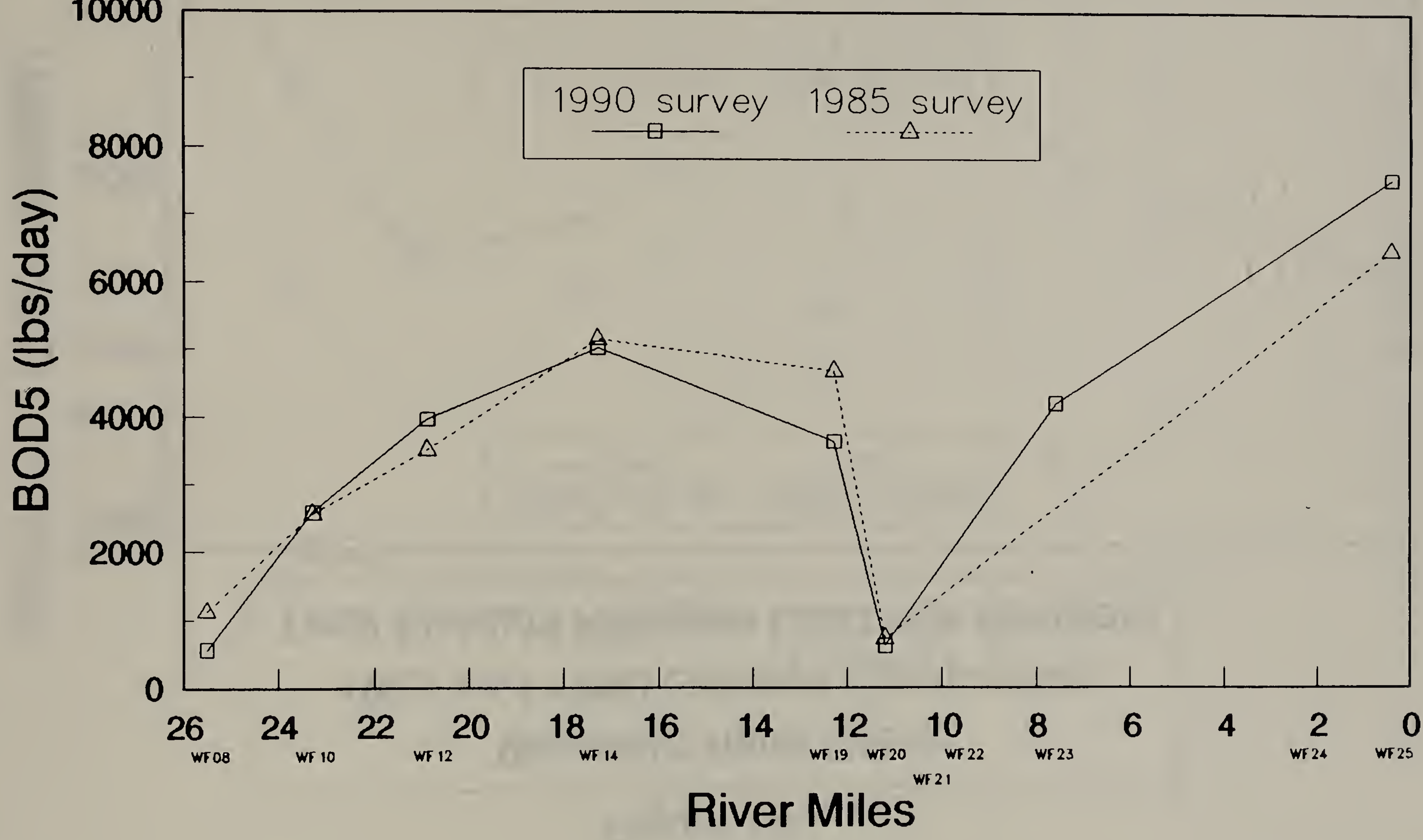


Figure 13

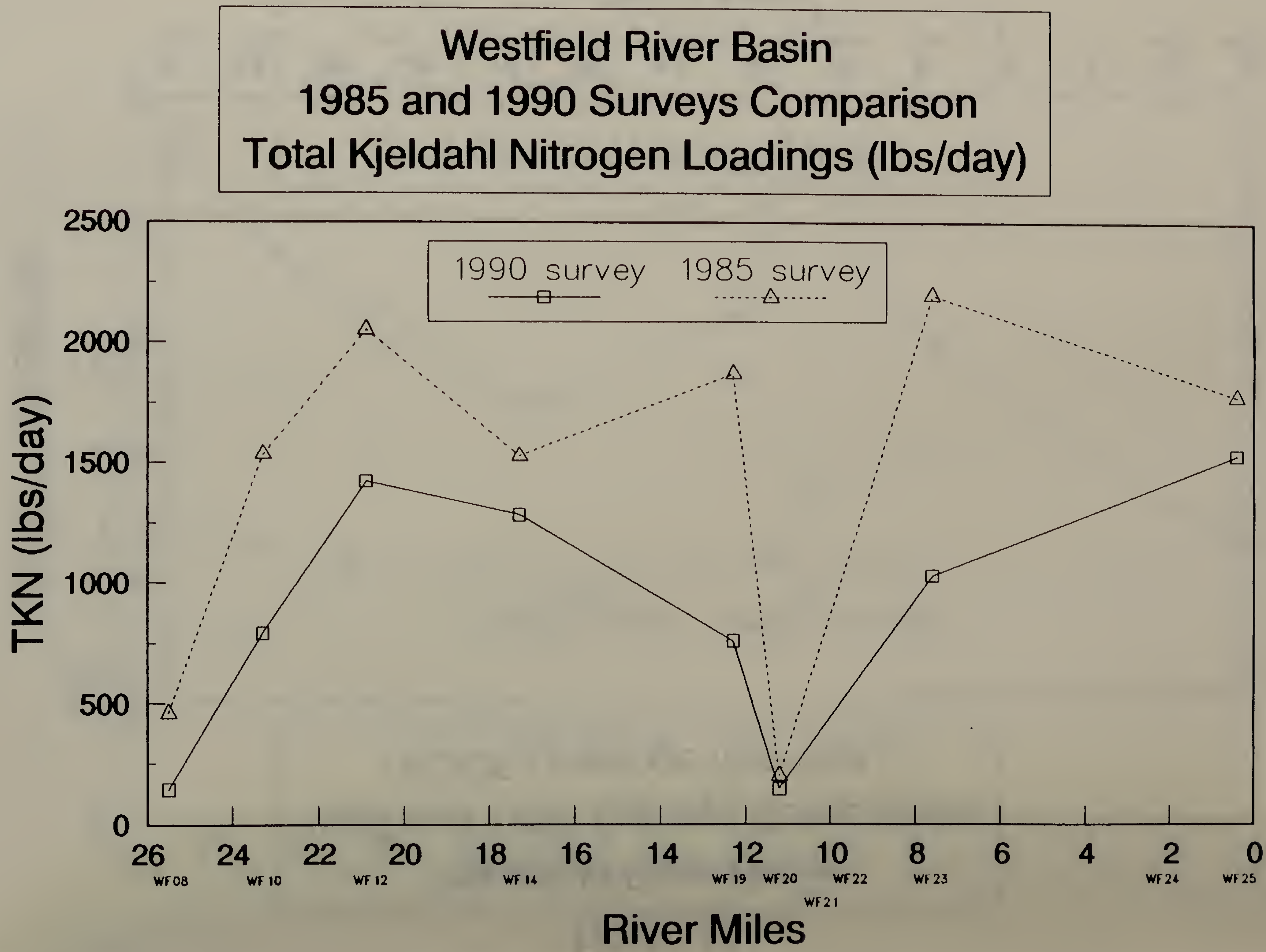


Figure 14

Figure 14

Westfield River Basin
1985 and 1990 Surveys Comparison
Suspended Solids (lbs/day)

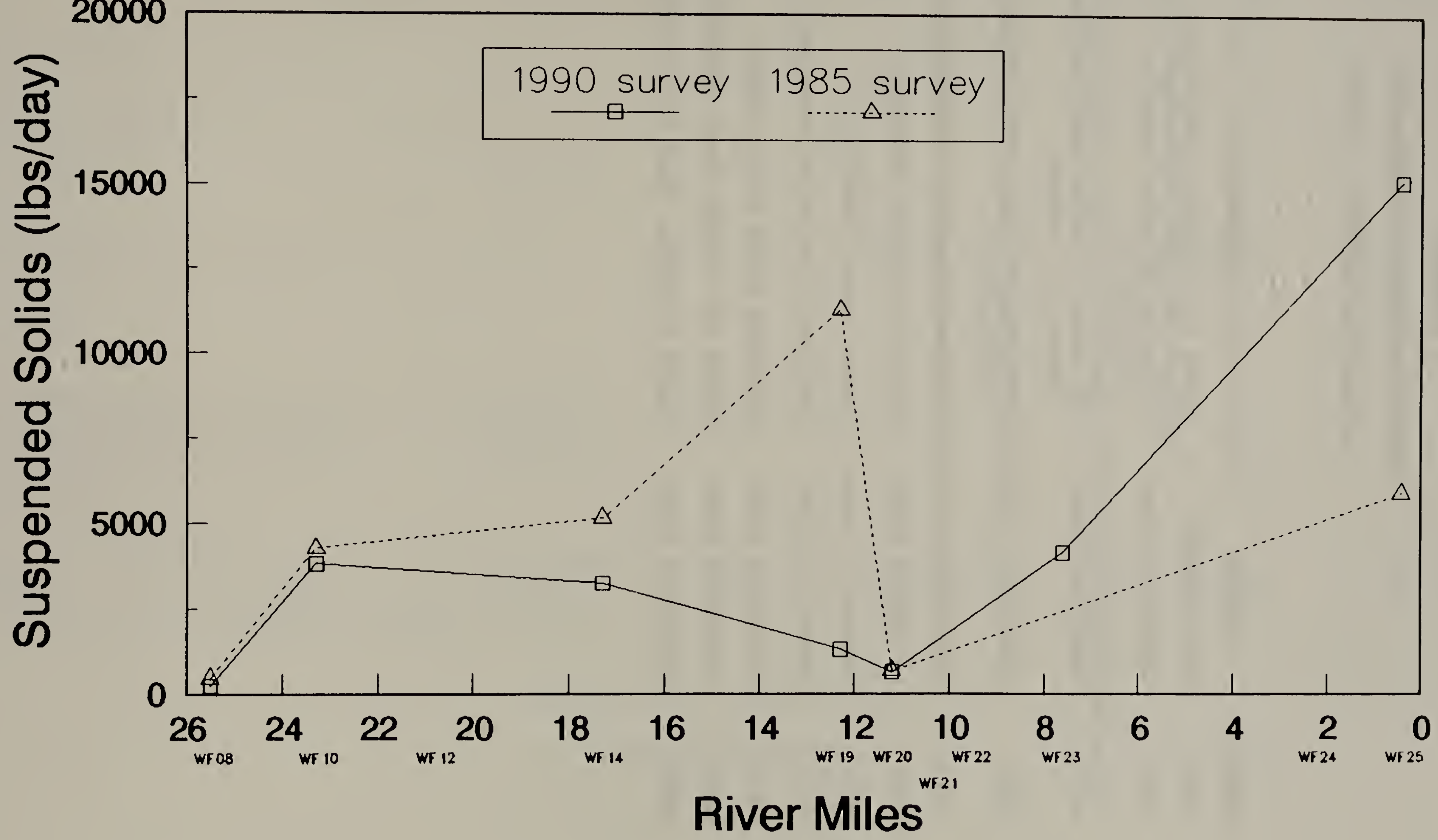


TABLE 1

1990 WESTFIELD RIVER BASIN

LOCATION OF SAMPLING STATIONS

STATION	STREAM	LOCATION	RIVER MILE
WF08	West Branch	Route 112 bridge, Huntington	25.5 (25.1 + 0.4)
WF10	Westfield River	Off Route 20 below Texon Co., Huntington	24.7
WF12	Westfield River	Off Route 20 below Westfield Paper Co., Russell	20.9
WF14	Westfield River	Off Route 20 below Mass. Pike, Westfield	17.3
WF19	Little River	Off South Meadow Road, Westfield	11.2 (11.0 + 0.2)
WF20	Westfield River	Route 202 bridge, Westfield	12.3
WF21	Powdermill Brook	Union Street, Westfield	10.1 (10.0 + 0.1)
WF22	Westfield River	Frog Hole, Route 20, Westfield	9.9
WF23	Westfield River	Robinson State Park, Agawam	7.6
WF24	Westfield River	Route 147 bridge, West Springfield	2.2
WF25	Westfield River	Route 5 bridge, West Springfield	0.4

TABLE 2

1990 WESTFIELD RIVER BASIN

LIST OF DISCHARGES

1. Huntington Wastewater Treatment Facility

2. Russell Wastewater Treatment Facility

3. Strathmore Paper Company, Woronoco Mills Wastewater Treatment Facility

4. Westfield Wastewater Treatment Facility

5. Columbia Manufacturing Wastewater Treatment Facility

TABLE 3

WEST RIVER BASIN

RIVER SEGMENT CLASSIFICATION

SEGMENT DESCRIPTION	RIVER MILES	WATER USE CLASSIFICATION	SUPPORT STATUS	WATER QUALITY PROBLEMS	SOURCE(S) OF PROBLEMS	ABATEMENT NEEDS TO MEET CLASSIFICATION
West Branch Westfield River						
Source in Becket to confluence with main stem Westfield River, Huntington	17.5-7.5 7.5-0.0	B/SCWF/AD B/SCWF	S	-	-	-
Middle Branch Westfield River						
Source in Peru to Littleville Dam, Huntington	18.1-1.0	A	S	-	-	-
Littleville Dam to confluence with main stem Westfield River, Huntington	1.0-0.0	B/SCWF/AD	S	-	-	-
Mainstem Westfield River						
Source in Savoy to confluence with West Branch, Huntington	62.5-25.1	B/CWF/AD	S	-	-	-
From confluence with West Branch to Rte. 202 bridge, Westfield	25.1-12.3	B/WWF	S	-	-	-

TABLE 3 (CONTINUED)

SEGMENT DESCRIPTION	RIVER MILES	WATER USE CLASSIFICATION	SUPPORT STATUS	WATER QUALITY PROBLEMS	SOURCE(S) OF PROBLEMS	ABATEMENT NEEDS TO MEET CLASSIFICATION
Rte. 202 bridge to Agawam town line	12.3-7.8	B/WWF	PS	Fecal coliform bacteria	-CSOs -Failing on-site systems	-CSO abatement. -Better maintenance, or tie into sewer.
Agawam town line to confluence with Connecticut River, W. Springfield	7.8-0.0	B/WWF	NS	Fecal coliform bacteria	-CSOs -DWOs	-CSO abatement.
Little River						
From Horton's Bridge to confluence with Westfield River, Westfield	4.7-0.0	B/SCWF	NS	Fecal coliform bacteria	-Failing on-site systems -CSOs	-Better maintenance, or tie into sewer. -CSO abatement.
Powdermill Brook						
From confluence with Arm Brook to confluence with Westfield River, Westfield	3.2-0.0	B/SCWF/AD	S	-	-	-

Miles Assessed: 106.0 mi
Miles Supporting Classification: 89.0 mi
Miles Partially Supporting Classification: 3.5 mi

1990 WESTFIELD WATER QUALITY DATA

TABLE 4

1990 WESTFIELD RIVER BASIN

TIME, TEMPERATURE, DISSOLVED OXYGEN, pH

STATION		JUNE 27, 1990	AUGUST 8, 1990	SEPTEMBER 19, 1990
WF08	*	0935	0930	1030
	**	71	75	65
	***	8.4	8.0	7.5
	****	7.3	6.4	6.5
WF10		1025	1015	1050
		73	70	66
		8.1	9.0	8.0
		7.2	6.7	6.0
WF12		1054	1045	1120
		75	71	66
		8.1	8.0	8.0
		7.2	6.5	6.5
WF14		1152	1125	1145
		76	70	68
		8.1	7.5	7.5
		6.5	6.4	7.0
WF19		1235	1205	1215
		74	72	68
		8.4	8.0	7.6
		7.1	6.4	6.1
WF20		1218	1215	1227
		76	72	66
		7.5	8.5	9.0
		7.1	6.4	6.2
WF21		1310	1230	1315
		68	69	60
		8.5	7.0	8.5
		6.9	6.4	6.4
WF22		1249	1250	1325
		77	72	68
		7.7	8.0	8.0
		6.9	6.4	6.4
WF23		1353	0120	1340
		76	72	66
		7.5	7.6	7.5
		7.1	6.4	6.5
WF24		1416	0130	1355
		78	72	69
		8.2	8.7	9.0
		7.1	6.4	6.5
WF25		1428	1342	1410
		76	74	68
		7.6	7.6	8.5
		7.1	6.3	6.8

* Time (DST)
** Temperature (°F)
*** Dissolved Oxygen (mg/l)
**** pH (Standard Units)

TABLE 5

1990 WESTFIELD RIVER BASIN

SUMMARY OF DISSOLVED OXYGEN (mg/l)

STATION	MAX.	MIN.	AVG.
WF08	8.4	7.5	8.0
WF10	9.0	8.0	8.5
WF12	8.1	8.0	8.1
WF14	8.1	7.5	7.8
WF19	8.4	7.6	8.0
WF20	9.0	7.5	8.3
WF21	8.5	7.0	7.8
WF22	8.0	7.7	7.9
WF23	7.6	7.5	7.6
WF24	9.0	8.2	8.6
WF25	8.5	7.6	8.1

TABLE 6

1990 WESTFIELD RIVER BASIN

BOD_5 (mg/l)

STATION	JUNE 27, 1990	AUGUST 8, 1990	SEPTEMBER 19, 1990
WF08	2.4	3.6	2.4
WF10	2.4	1.8	1.8
WF12	3.6	3.3	2.7
WF14	3.3	2.4	4.8
WF19	3.3	2.4	1.8
WF20	4.2	4.5	1.5
WF21	-	2.4	1.5
WF22	7.2	2.4	2.7
WF23	3.3	3.0	2.1
WF24	3.9	2.4	2.4
WF25	7.2	3.0	2.0

- No measurement taken

TABLE 7

1990 WESTFIELD RIVER BASIN

AMMONIA-NITROGEN, NITRATE-NITROGEN, KJELDAHL-NITROGEN, pH, ALKALINITY

(All results in mg/l unless noted)

June 27, 1990

STATION	AMMONIA-NITROGEN	NITRATE-NITROGEN	TOTAL KJELDAHL NITROGEN	pH*	ALKALINITY
WF08	0.03	0.21	0.34	6.5	19
WF10	0.04	0.30	0.22	6.5	18
WF12	0.29	0.24	1.4	6.3	13
WF14	0.27	0.25	0.95	6.5	18
WF19	0.06	0.83	0.47	6.5	18
WF20	0.24	0.89	0.71	6.6	18
WF21	0.13	1.16	0.49	-	-
WF22	0.46	0.66	0.90	6.6	21
WF23	0.21	0.89	0.53	6.7	26
WF24	0.19	0.87	0.71	6.8	25
WF25	0.30	0.89	1.3	6.7	24

- No measurement taken
* Result in standard units

TABLE 8

1990 WESTFIELD RIVER BASIN

AMMONIA-NITROGEN, NITRATE-NITROGEN, KJELDAHL-NITROGEN, pH, ALKALINITY

(All results in mg/l unless noted)

August 8, 1990

STATION	AMMONIA-NITROGEN	NITRATE-NITROGEN	TOTAL KJELDAHL NITROGEN	pH*	ALKALINITY
WF08	0.02	0.16	0.68	6.8	13
WF10	0.02	0.26	0.57	6.4	9
WF12	0.08	0.22	0.49	6.4	9
WF14	0.10	0.92	0.45	6.4	10
WF19	0.03	0.51	0.59	6.5	12
WF20	0.14	0.55	0.92	6.5	10
WF21	0.14	600	0.91	6.9	37
WF22	0.15	0.35	0.99	6.5	11
WF23	0.08	0.34	0.61	6.5	12
WF24	0.09	0.52	0.68	6.6	12
WF25	0.14	0.52	0.94	6.6	12

* Results in standard units

TABLE 9

1990 WESTFIELD RIVER BASIN

AMMONIA-NITROGEN, NITRATE-NITROGEN, KJELDAHL-NITROGEN, pH, ALKALINITY

(All results in mg/l unless noted)

September 12, 1990

STATION	AMMONIA-NITROGEN	NITRATE-NITROGEN	TOTAL KJELDAHL NITROGEN	pH*	ALKALINITY
WF08	0.04	0.41	0.83	6.9	22
WF10	0.15	-	1.1	6.9	19
WF12	0.29	0.56	0.89	6.9	20
WF14	0.18	0.52	1.1	6.3	20
WF19	0.08	1.08	0.79	6.4	19
WF20	0.11	0.43	0.49	6.5	21
WF21	0.09	1.45	0.63	6.8	44
WF22	0.59	0.79	1.1	6.6	24
WF24	0.16	1.02	0.83	7.1	28
WF25	0.24	1.05	0.62	6.8	30

- No measurement taken
* Results in standard units

TABLE 10

1990 WESTFIELD RIVER BASIN

TOTAL PHOSPHORUS, SUSPENDED SOLIDS, FECAL COLIFORM, CHLORIDE, AND HARDNESS

(All results in mg/l unless noted)

June 27, 1990

STATION	TOTAL PHOSPHORUS	SUSPENDED SOLIDS	FECAL* COLIFORM	CHLORIDE	HARDNESS
WF08	0.09	<1	20	9.5	25
WF10	0.09	3.0	60	7.2	24
WF12	0.10	5.0	100	12	22
WF14	0.05	2.5	80	10	24
WF19	0.08	1.0	200	11	26
WF20	0.06	1.0	60	9.9	25
WF21	0.06	-	160	-	53
WF22	0.10	3.5	120	14	23
WF23	0.09	2.5	80	14	31
WF24	0.11	5.5	2,000	14	32
WF25	0.12	9.0	1,500	16	33

- No measurement taken
* Results in org/100 ml

TABLE 11

1990 WESTFIELD RIVER BASIN

TOTAL PHOSPHORUS, SUSPENDED SOLIDS, FECAL COLIFORM, CHLORIDE, AND HARDNESS

(All results in mg/l unless noted)

August 8, 1990

STATION	TOTAL PHOSPHORUS	SUSPENDED SOLIDS	FECAL* COLIFORM	CHLORIDE	HARDNESS
WF08	0.04	2.5	400	6	21
WF10	0.16	12	2,400	3	16
WF12	0.13	9.5	2,600	4	17
WF14	0.06	15	14,000	4	43
WF19	0.07	9.0	1,800	8	19
WF20	0.11	16	14,000	4	17
WF21	0.13	6.0	1,000	26	54
WF22	0.15	14	23,000	5	18
WF23	0.12	18	13,000	6	18
WF24	0.12	20	7,000	5	18
WF25	0.18	7.0	10,000	6	20

* Results in org/100 ml

TABLE 12

1990 WESTFIELD RIVER BASIN

TOTAL PHOSPHORUS, SUSPENDED SOLIDS, FECAL COLIFORM, CHLORIDE, AND HARDNESS

(All results in mg/l unless noted)

September 12, 1990

STATION	TOTAL PHOSPHORUS	SUSPENDED SOLIDS	FECAL* COLIFORM	CHLORIDE	HARDNESS
WF08	0.04	9.5	40	1	25
WF10	0.09	11	90	7	26
WF12	0.08	13	80	8	25
WF14	0.05	10	150	10	28
WF19	0.05	6.5	180	12	28
WF20	0.11	12	180	11	31
WF21	0.29	10	440	27	32
WF22	0.15	12.2	420	14	53
WF23	0.12	15	480	6	18
WF24	0.13	16	100	5	18
WF25	0.19	19	4,400	6	20

* Results in org/100 ml

TABLE 13

1990 WESTFIELD RIVER BASIN

FECAL COLIFORM

(Results in org/100 ml)

October 10, 1990

STATION	FECAL COLIFORM
WF08	200
WF12	600
WF20	300
WF22	3,000
WF24	2,100

TABLE 14

1990 WESTFIELD RIVER BASIN

METALS (mg/l)

June 27, 1990

STATION	IRON	MANGANESE	ALUMINUM	COPPER	ZINC	LEAD	CHROMIUM	CADMIUM	NICKEL	SILVER
WF12	0.15	0.04	0.37	0.013	0.05	0.003	0.001	0.001	0.002	<0.001
WF19	0.13	0.04	0.38	0.008	0.02	<0.002	<0.001	<0.001	<0.002	<0.001
WF21	0.47	0.06	0.95	0.008	0.03	0.002	0.003	0.002	<0.002	<0.001
WF22	0.08	<0.02	0.43	0.009	0.02	0.009	0.003	<0.001	0.005	<0.001
WF23	0.21	0.04	0.60	0.005	0.02	0.004	0.014	<0.001	0.003	<0.001
WF24	0.24	0.04	0.60	0.009	0.06	0.011	0.004	0.003	0.005	<0.001
WF25	0.40	0.08	0.63	0.011	0.06	0.030	0.005	0.001	0.005	<0.001

TABLE 15

1990 WESTFIELD RIVER BASIN

METALS (mg/l)

August 8, 1990

STATION	ALUMINUM	COPPER	ZINC	LEAD	CHROMIUM	CADMIUM	NICKEL	MERCURY
WF12	0.38	0.003	0.034	0.003	0.002	<0.001	0.002	0.0002
WF14	0.46	0.003	0.052	0.004	0.003	<0.001	0.002	<0.0002
WF15	0.29	<0.002	0.029	0.006	0.001	<0.001	0.002	<0.0002
WF20	0.25	0.002	0.027	0.003	<0.001	<0.001	<0.002	0.0003
WF21	0.49	0.004	0.028	0.003	0.004	<0.001	0.002	<0.0002
WF22	0.42	0.003	0.064	0.006	0.002	<0.001	0.003	<0.0002

TABLE 16(a)

1990 WESTFIELD RIVER BASIN

METALS (mg/l)

September 12, 1990

STATION	IRON	ALUMINUM	COPPER	ZINC	LEAD
WF12	0.20	0.09	0.005	0.041	0.003
WF14	0.20	0.16	0.005	0.119	0.005
WF20	0.15	0.06	0.003	0.076	0.003

STATION	CHROMIUM	CADMIUM	NICKEL	MERCURY
WF12	<0.001	0.006	<0.002	<0.0002
WF14	<0.001	<0.006	<0.002	<0.0002
WF20	<0.001	<0.001	<0.002	<0.0002

TABLE 16(b)

EPA FRESHWATER METALS CRITERIA FOR AQUATIC LIFE PROTECTION

($\mu g/l$)

JANUARY 1991

	METAL		CRITERIA	HARDNESS (MG/L $CaCo_3$) 25	30	40	50	100	200
1.	Aluminum	Chronic	.087	-	-	-	-	-	-
		Acute	.750						
2.	Cadmium	Chronic	-	.00038	.00440	.00055	.00066	.0011	.0020
		Acute	-	.00082	.00100	.00144	.00180	.0039	.0086
3.	Chromium III	Chronic	-	.066	.077	.098	.120	.210	.370
		Acute	-	.558	.648	.820	.980	1.700	3.100
4.	Copper	Chronic	-	.0036	.0042	.0054	.0065	.012	.021
		Acute	-	.0048	.0057	.0075	.0092	.018	.034
5.	Iron	Maximum	1.0	-	-	-	-	-	-
6.	Lead	Chronic	-	.00054	.00068	.00099	.0013	.0032	.0077
		Acute	-	.012	.015	.025	.034	.082	.200
7.	Nickel	Chronic	-	.049	.056	.073	.088	.016	.280
		Acute	-	.440	.512	.653	.790	1.40	2.5

TABLE 17

1990 WESTFIELD RIVER BASIN

MICROTOX™ SAMPLES TESTED

LOG NO.	SITE	SAMPLE TYPE	DATE COLLECTED	DATE TESTED	COLLECTOR	LAB pH (Std. Units)
306	WF12	Instream Grab	6/27/90	6/29/90	Dunn	6.7
307	WF22	Instream Grab	6/27/90	6/28/90	Dunn	6.8
307D	WF22	Instream Grab	6/27/90	6/28/90	Dunn	6.7
308	WF25	Instream Grab	6/27/90	6/28/90	Dunn	6.8
*	WF22	Instream Grab	7/11/90	7/12/90	Dunn	-
327	WF12	Instream Grab	8/8/90	8/9/90	Dunn	6.3
328	WF19	Instream Grab	8/8/90	8/9/90	Dunn	6.4
329	WF22	Instream Grab	8/8/90	8/9/90	Dunn	-
330	WF25	Instream Grab	8/8/90	8/9/90	Dunn	6.4
343	WF22	Instream Grab	10/11/90	10/12/90	Dunn	-

* Log no. not established
\- No measurement taken

TABLE 18

1990 WESTFIELD RIVER BASIN

MICROTOX™ RESULTS

LOG NO.	5-MINUTE	15-MINUTE	30-MINUTE	
306	52%	*	*	EC10
307	<5.6%	<5.6%	<5.6%	EC10
307D	<5.6%	<5.6%	<5.6%	EC10
308	*	*	*	EC10
306	>100%	*	*	EC20
307	<5.6%	<5.6%	<5.6%	EC20
307D	<5.6%	<5.6%	<5.6%	EC20
308	*	*	*	EC20
306	>100%	*	*	EC50
307	<5.6%	<5.6%	<5.6	EC50
307D	<5.6%	<5.6%	<5.6	EC50
308	*	*	*	EC50
7/13/90 Sample (WF22)	*	*	*	EC50
327	>100%	>100%	>100%	EC10
328	>100%	>100%	*	EC10
329	*	*	*	EC10
330	*	*	*	EC10
343	*	*	*	EC10

* Spurious Results - Negative Gamma Values

TABLE 18 (CONTINUED)

LOG NO.	5-MINUTE	15-MINUTE	30-MINUTE	
327	>100%	>100%	>100%	EC20
328	>100%	>100%	*	EC20
329	*	*	*	EC20
330	*	*	*	EC20
343	*	*	*	EC20
327	>100%	>100%	>100%	EC50
328	>100%	>100%	*	EC50
329	*	*	*	EC50
330	*	*	*	EC50
343	*	*	*	EC50

TABLE 19

1990 WESTFIELD RIVER BASIN

GAS CHROMATOGRAPHY - MASS SPECTROMETRY ANALYSIS

OF PURGEABLE ORGANICS ($\mu g/l$)

LAB NUMBER	STATION NUMBER	LOCATION	DATE SAMPLED	ORGANIC DETECTED	LEVEL
038813	WF12	Westfield R., Russell	6/27/90	None	-
038814	WF22	Westfield R., Westfield	6/27/90	None	-
038815	WF25	Westfield R., W. Springfield	6/27/90	None	-
039024	WF12	Westfield R., Russell	8/8/90	None	-
039023	WF22	Westfield R., Westfield	8/8/90	None	-
039025	WF25	Westfield R., W. Springfield	8/8/90	None	-
039171	WF12	Westfield R., Russell	9/12/90	Methyl Ethyl Ketone	3.7
039173	WF22	Westfield R., Westfield	9/12/90	None	-
039172	WF25	Westfield R., W. Springfield	9/12/90	None	-

TABLE 20

1990 WESTFIELD RIVER BASIN

CHLOROPHYLL a AND ALGAE COUNTS

LAB NUMBER	STATION NUMBER	LOCATION	DATE SAMPLED	ALGAE COUNT NATURAL UNIT/ml	CHLOROPHYLL a (mg/m3)
47	WF12	Westfield R., Russell	8/8/90	285	6.6
48	WF22	Westfield R., Westfield	8/8/90	241	7.92
49	WF25	Westfield R., W. Springfield	8/8/90	241	8.58
91	WF12	Westfield R., Russell	9/12/90	109	0.87
92	WF22	Westfield R., Westfield	9/12/90	164	1.66
93	WF25	Westfield R., W. Springfield	9/12/90	327	2.66

TABLE 21

1990 WESTFIELD RIVER BASIN

RAINFALL DATA (June 10 - Sept. 13) UNITS = INCHES

DATE	WESTFIELD, MA	KNIGHTVILLE DAM
6/10/90	-	.07
6/12/90	.12	.07
6/15/90	-	.10
6/19/90	.11	-
6/20/90	-	.03
6/24/90	-	.18
6/26/90	-	.01
6/30/90	-	.53
JUNE 10 - 30 TOTAL	.23	.99
7/2/90	.70	-
7/5/90	-	.10
7/10/90	-	.13
7/12/90	-	.01
7/13/90	1.60	1.13
7/21/90	-	.05
7/24/90	.15	.03
7/25/90	.48	-
JULY TOTAL	2.93	1.50
8/1/90	.01	-
8/6/90	.06	.12
8/7/90	1.98	2.32
8/8/90	.54	.77
8/11/90	3.68	2.01
8/12/90	.73	.45
8/14/90	.72	.36
8/20/90	.16	.64
8/24/90	.27	.72
8/25/90	2.10	.92
8/26/90	-	.02
8/29/90	.05	.09
AUGUST TOTAL	10.30	8.42
9/3/90	-	.05
9/8/90	-	.01
9/10/90	.08	.03
9/12/90	.40	.15
SEPT. 1-14 TOTAL	.48	.24

- No measurement of rainfall recorded

TABLE 22

1990 WESTFIELD RIVER BASIN

FLOW DATA (cfs)

STATION	6/26	6/27	6/28	8/7	8/8	8/9	9/10	9/11	9/12	10/10
#1795 ½ mi. below Knightville Dam river mi. 26.0; E. Branch Westfield River	133	117	101	781	1630	844	90	127	114	-
#1805 Middle Br., Westfield River; ½ mi. upstream of confluence with Westfield Main Branch	18	15	13	156	290	128	11	14	16	-
#1810 West Br., Westfield River; 1.1 mi. upstream from survey Station WF01	46	41	37	864	278	115	31	40	39	-
Huntington WWTP near WF08, Rte. 112 Bridge, (River mi. 25.4)	0.128	0.116	0.111	0.140	0.115	0.111	0.113	0.103	0.110	0.121
Russell WWTP, ½ mi. upstream of WF12 (River mi. 21.4)	0.136	0.151	0.182	0.218	0.215	0.210	0.147	0.158	0.136	0.127
Strathmore Paper Co., WWTP Woronoco, near Strathmore Road Bridge (River mi. 18.5)	4.01	4.10	4.07	4.86	4.84	4.53	5.25	4.13	4.25	4.04
Westfield WWTP, Westfield (River mi. 10.6)	4.46	4.41	4.35	5.06	4.79	4.51	4.48	4.49	4.39	3.71
Columbia Bicycle, Little River (River mi. 12.2)	-	-	-	-	-	-	-	-	-	0.38
#1795 Main Br., Westfield R., Westfield River Mile 8.7, 1.2 mi. downstream of survey Sta. WF22 and 1.1 upstream of Sta. WF23	339	305	268	1560	2340	1710	235	259	256	-

- No data available

TABLE 23

WESTFIELD RIVER BASIN

1990 EXISTING INSTREAM AND WASTEWATER TREATMENT PLANT DISCHARGES

LOADING DATA

(All results in lbs/day unless noted)

	WF08				HUNTINGTON WWTP DISCHARGE				WF10		
STATION:	6/27	8/8	9/12	10/10	6/27	8/8	9/12	10/10	6/27	8/8	9/12
PARAMETER											
Flow (cfs)	44	285	43	-	0.116	0.115	0.110	0.121	237	2125	220
Flow Factor (cfs/mi^2)	0.83	5.41	0.82	-	-	-	-	-	0.71	6.4	0.66
Q (FF X Area)	44	285	43	-	-	-	-	-	236	2132	220
BOD_5	568	5520	555	-	93.6	7	12.4	17.6	3047	20646	2130
Suspended Solids	237	3833	-	-	14	8.6	-	4.3	3809	137190	-
Total Kjeldahl-N	95	1043	192	-	1.1	2.2	1.1	2.7	279	6520	1302
Ammonia-Nitrogen	7.1	31	9.3	-	0.03	0.5	0.10	0.27	51	229	178
Nitrate-Nitrogen	40.5	245	94.9	-	3.8	5.4	9.1	5.7	381	2982	1420
Total Phosphorus	21.3	61	9.3	-	1.6	2.3	1.5	3.8	114	1835	106
Fecal Coliform/100ml	20	400	40	720	36	42	37	34	60	2400	90
										WF12	
Iron	-	-	-	-	0.04	-	0.002	0.22	192	-	-
Aluminum	-	-	-	-	0.50	-	0.06	0.03	473	2858	-
Copper	-	-	-	-	0.10	-	0.05	0.10	17	34.3	-
Zinc	-	-	-	-	0.04	-	0.07	0.03	64	389	-
Lead	-	-	-	-	0.001	-	0.001	<0.001	3.8	34.3	-
Chromium	-	-	-	-	0.001	-	0.011	<0.001	1.3	22.9	-
Cadmium	-	-	-	-	0.002	-	0.005	<0.001	1.3	<11	-

TABLE 23 (CONTINUED)

	RUSSELL WWTP DISCHARGE				STRATHMORE PAPER WWTP DISCHARGE				WF14		
STATION:	6/27	8/8	9/12	10/10	6/27	8/8	9/12	10/10	6/27	8/8	9/12
PARAMETER											
Flow (cfs)	0.151	0.215	0.136	0.127	4.01	4.84	4.07	4.04	239	2165	223
Flow Factor (cfs/mi^2)	-	-	-	-	-	-	-	-	0.68	6.12	0.63
Q (FF X Area)	-	-	-	-	-	-	-	-	241	2166	223
BOD_5	215.2	40.4	30.7	28.7	12944	1164	1774	-	4279	27954	5759
Suspended Solids	2.7	58.3	-	-	205	-	-	-	3241	174715	-
Total Kjeldahl-N	7.3	11.2	6.4	2.9	9.9	29	74	45.6	1247	5241	1320
Ammonia-Nitrogen	6.9	7.5	4.4	0.08	<0.4	<0.4	2.6	0.43	350	1165	216
Nitrate-Nitrogen	0.07	0.30	2.3	0.70	1.9	5.4	21.9	4.8	604	10716	624
Total Phosphorus	1.3	2.8	0.90	1.4	3.9	5.6	5.5	4.3	63.9	699	60
Fecal Coliform 100/ml	7000	-	91000	240	<20	2000	20	-	80	14000	150
Iron	0.04	-	-	0.23	-	-	-	2.4	-	-	-
Aluminum	0.82	-	-	0.07	-	-	-	15.2	-	-	240
Copper	0.04	-	-	0.19	-	-	-	<0.2	-	-	192
Zinc	0.10	-	-	0.10	-	-	-	1.1	-	-	6
Lead	<0.002	-	-	<0.001	-	-	-	<0.04	-	-	143
Chromium	<0.001	-	-	0.001	-	-	-	<0.02	-	-	<1
Cadmium	0.010	-	-	<0.001	-	-	-	<0.02	-	-	7.2

TABLE 23 (CONTINUED)

STATION:	COLUMBIA MFG. WWTP	WF19 LITTLE RIVER			WF20*				WESTFIELD WWTP DISCHARGE			
	10/10	6/27	8/8	9/12	6/27	8/8	9/12	10/10	6/27	8/8	9/12	10/10
PARAMETER												
Flow (cfs)	0.38	47.5	360	40	240	2200	225	-	4.41	4.79	4.39	3.71
Flow Factor (cfs/mi^2)	-	0.58	4.36	0.48	0.65	5.94	0.61	-	-	-	-	-
Q (FF X Area)	-	48	360	40	241	2198	226	-	240	15	35	47
BOD_5	-	852	4648	387	5445	53262	1824	-	5694	387	819	938
Suspended Solids	-	646	17431	-	1297	189203	-	-	1572	1701	1240	659
Total Kjeldahl-N	-	121	1142	170	920	10879	593	-	641	242	304	579
Ammonia-Nitrogen	-	15.5	58	17.2	311	1655	133	-	332	31.4	281	339
Nitrate-Nitrogen	-	214	988	232	1149	6504	521	-	37.2	335	26.9	32
Total Phosphorus	-	20.7	136	10.8	76.3	1301	133	-	61.7	36	56.2	71.9
Fecal Coliform/100 ml	200	1800	180	60	14000	180	-	-	60	110	<10	-
Iron	-	-	-	-	-	-	-	-	1.7	-	3.0	8.2
Aluminum	0.03	32.7	-	-	-	-	182	-	36	-	1.9	4.4
Copper	<0.01	203	-	-	-	2959	73	-	-	-	0.05	10
Zinc	0.06	2.0	-	-	-	23.7	3.6	-	1.2	-	1.3	2.6
Lead	0.03	5.0	-	-	-	402	92	-	0.09	-	0.07	0.21
Chromium	0.02	<0.03	-	-	-	268	<1	-	2.6	-	<0.02	8.8
Cadmium	<0.01	<0.03	-	-	-	<134	<1	-	0.09	-	<0.02	0.80
Nickel	-	-	-	-	-	-	-	-	-	-	-	6.4

TABLE 23 (CONTINUED)

STATION:	WF21* POWDERMILL BK. 6/27	8/8	9/12	WF23* 6/27	8/8	9/12	WF25* 6/27	8/8	9/12
PARAMETER									
Flow (cfs)	11	87	9.7	309	2368	259	317	2425	266
Flow Factor (cfs/mi^2)	0.57	4.53	0.51	0.61	4.7	0.51	0.62	4.7	0.52
Q (FF X Area)	11	87	9.8	307	2364	257	312	2364	262
BOD_5	-	1123	79	5486	38220	2903	12086	38232	2960
Suspended Solids	-	2808	-	4129	228930	-	15107	89028	-
Total Kjeldahl-N	29	425	33	881	7758	1175	2182	11955	874
Ammonia-Nitrogen	7.6	66	4.7	349	1019	290	504	1781	338
Nitrate-Nitrogen	68.6	420	76	1480	4324	1438	1494	6613	1480
Total Phosphorus	3.6	60.8	15	150	1526	166	201	2289	268
Fecal Coliform/100 ml	160	1000	440	80	13000	480	1500	10000	4400
Iron	27.8	-	-	386	-	-	409	-	-
Aluminum	56.2	-	-	1023	5860	-	1023	3738	-
Copper	0.47	-	-	8.5	38	-	15.3	48.5	-
Zinc	1.8	-	-	34	662	-	102	378	
Lead	0.23	-	-	6.8	51	-	18.8	78.2	-
Chromium	0.02	-	-	23.9	38	-	6.8	13	-
Cadmium	0.01	-	-	<1.7	<1.2	-	5.1	<13	-

* Estimated Flows
\- No data collected, or not calculated

TABLE 24

WESTFIELD RIVER BASIN

1985 EXISTING INSTREAM AND WWTP DISCHARGE LOADINGS

(lbs/day average of 5/29, 7/17 survey days, except as noted)

STATION:	WP08	HUNTINGTON WWTP	WF10	RUSSELL WWTP	STRATHMORE PAPER CO.	WF14	COLUMBIA MANUFACTURING
PARAMETER							
Flow (cfs)	87	0.106	317	0.186	3.86	319	0.61
Q (FF X Area)	87	-	316	-	-	320	-
BOD_5	1123	21	2558	17	1495	5149	-
Suspended Solids	468	21	4264	32	498	2574	17
Total Kjeldahl-N	459	9.8	1535	7	73	1527	6.9
Ammonia-Nitrogen	-	0.18	51	3.2	2.9	275	0.10
Nitrate-Nitrogen	47	17.0	256	5.5	1.3	343	3.6
Total Phosphorus	14	15.0	136	2.7	41	68	2.0
Fecal Coliform/100 ml	100	<36	600	<36	<36	250	<36
				WF12			
Iron	-	-	136	188	-	-	2.7
Aluminum	-	-	<170	<170	-	-	0.5
Copper	-	-	<34	<34	-	-	0.13
Zinc	-	-	<51	<51	-	-	1.8
Chromium	-	-	<34	<34	-	-	0.13
Cadmium	-	-	<34	<34	-	-	0.07

TABLE 24 (CONTINUED)

STATION:	WF19 LITTLE RIVER	WF20	WESTFIELD WWTP DISCHARGE	WF21 POWDERMILL BK.	WF23	WF25
PARAMETER						
Flow (cfs)	612	322	4.05	19	340	343
Q (FF X Area)	-	323	-	19	338	339
BOD_5	723	4677	261	-	-	6459
Suspended Solids	678	11295	142	-	-	5905
Total Kjeldahl-N	199	1871	436	-	2195	1772
Ammonia-Nitrogen	6.8	364	200	-	402	314
Nitrate-Nitrogen	136	520	63	-	1098	1292
Total Phosphorus	32	173	98	-	201	221
Fecal Coliform/100 ml	1400	4630	93,000/ 240,000	-	120	2000
Iron	-	-	-	-	-	443
Aluminum	-	-	-	-	-	185
Copper	-	-	-	-	-	-
Zinc	-	-	-	-	-	<51
Chromium	-	-	-	-	-	<34
Cadmium	-	-	-	-	-	<34

- No data collected, or not calculated.

TABLE 25

1990 WESTFIELD RIVER BASIN

WATER QUALITY COMPARISON 1985 - 1990 SURVEYS

(Results in mg/l; except for pH and Fecal Coliform)

STATION:		WF08		WF10		WF14		WF19		WF20		WF23		WF25	
PARAMETER		1985	1990	1985	1990	1985	1990	1985	1990	1985	1990	1985	1990	1985	1990
pH		7.5	6.7	7.5	6.7	7.4	6.4	7.6	6.5	7.1	6.5	7.4	6.6	7.4	6.7
Dissolved Oxygen		8.6	8.0	8.8	8.5	7.4	7.8	9.3	8.0	8.0	8.3	8.3	7.6	8.3	8.1
Total Alkalinity		22	20	19	18	21	18	21	19	22	19	21	23	27	26
Hardness		29	24	23	22	26	32	29	24	28	25	34	22	38	24
BOD_5		2.4	5.2	1.5	3.0	3.0	3.5	4.1	2.5	2.7	3.4	3.3	2.8	3.4	4.1
Ammonia-Nitrogen		0.0	0.03	0.15	0.07	0.16	0.18	0.15	0.06	0.21	0.16	0.22	0.16	0.17	0.23
Nitrate-Nitrogen		0.1	0.26	0.15	0.28	0.2	0.56	0.6	0.81	0.3	0.62	0.6	0.76	0.65	0.82
Total Kjeldahl-N		0.98	0.62	0.91	0.62	0.89	0.83	0.88	0.62	1.08	0.71	1.2	0.66	0.97	0.95
Total Phosphorus		0.03	0.06	0.08	0.13	0.04	0.05	0.14	0.07	0.10	0.09	0.11	0.11	0.12	0.16
Suspended Solids		1.0	4.3	2.5	8.7	1.5	9.1	1.5	5.5	6.5	9.7	1.6	11.8	3.31	11.7
Fecal Coliform	**		93		75		115		190		340		280		3050
/100 ml	***	100	170	110	850	250	4743	1066	727	820	3635	2100	4520	3000	5300
Chloride		6.0	5.5	6.0	4.4	7.0	8.0	9.0	10.3	-	8.3	14	8.7	139	9.3
						WF16						WF22			
Iron		-		0.08	0.18	0.46	0.20	-	0.13	-	0.15	0.26	0.21	0.24	0.40
Aluminum		-		<0.10	0.28	<0.10	0.31	-	0.38	-	0.16	<0.10	0.60	0.10	0.63
Copper		-		<0.02	0.006	<0.02	0.004	-	0.008	-	0.003	-	0.005	-	0.011
Zinc		-		<0.03	0.026	<0.03	0.085	-	0.02	-	0.051	<0.03	0.02	<0.03	0.06
Chromium		-		<0.02	0.001	<0.02	<0.002	-	<0.001	-	<0.001	<0.02	0.014	<0.02	0.005
Cadmium		-		<0.02	0.003	<0.02	0.003	-	<0.001	-	<0.001	<0.02	<0.001	<0.02	0.001

\- No data, or lab analysis incomplete.
** 1990 Fecal Coliform, average of 6/27, 9/12 survey dates.
*** 1990 Fecal Coliform, average of 6/27, 8/8, 9/12 survey dates (incl. 8/8 wet weather).

TABLE 26

1990 WESTFIELD RIVER BASIN

COMPARISON OF INSTREAM LOADINGS 1985 and 1990* (lbs/day)

STATION:	WF08		WF10		WF12		WF14	
PARAMETER	1985	1990	1985	1990	1985	1990	1985	1990
Flow (CFS)**	87	44	317	229	318	230	319	231
BOD_5	1,123	562	2,558	2,589	3,507	3,960	5,149	5,019
Ammonia-Nitrogen	-	8.2	51	115	342	359	275	283
Nitrate-Nitrogen	47	67.7	256	901	513	495	343	614
Total Kjeldhal-N	459	143	1,535	791	2,053	1,423	1,527	1,284
Total Phosphorus	14	15	136	110	86	111	68	62
Suspended Solids	468	237	4,264	3,809	-	-	5,149	3,241
Chloride	2,808	-	10,223	8,624	-	12,374	12,013	9,942
Iron	-	-	136	192	188	186	-	-
Aluminum	-	-	<170	473	<170	470	-	240
Copper	-	-	<34	17	<34	10	-	192
Zinc	-	-	<51	64	<40	52	-	6
Chromium	-	-	<34	1.3	<34	2.4	-	<1
Cadmium	-	-	<34	1.3	<34	<1.2	-	7.2

* 1990 data based on survey dates 6/27, 9/12.
** Flow rep. average of 5/29/85, 7/17/85; 6/27/90, 9/12/90.

TABLE 26 (CONTINUED)

STATION:	WF19		WF20		WF23		WF25	
PARAMETER	1985	1990	1985	1990	1985	1990	1985	199
Flow (CFS)**	42	44	322	232	340	284	343	29
BOD_5	723	620	4,677	3,634	-	4,195	6,459	7,52
Ammonia-Nitrogen	6.8	16.4	364	222	402	320	314	42
Nitrate-Nitrogen	136	223	520	835	1,098	1,459	1,292	1,48
Total Kjeldahl-N	199	145	1,871	757	2,195	1,028	1,772	1,52
Total Phosphorus	32	15.8	173	105	201	158	221	23
Suspended Solids	678	646	11,295	1,297	-	4,129	5,905	15,10
Chloride	2,034	2,438	-	10,360	25,458	13,293	23,989	14,61
Iron	-	-	-	-	-	-	443	-
Aluminum	-	32.7	-	182	-	-	185	68
Copper	-	203	-	73	-	-	-	1,07
Zinc	-	2.0	-	3.6	-	-	<51	-
Chromium	-	<0.03	-	<1	-	-	<34	-
Cadmium	-	<0.03	-	<1	-	-	<34	-

* 1990 data based on survey dates 6/27, 9/12.
** Flow rep. average of 5/29/85, 7/17/85; 6/27/90 9/12/90.
\- No data collected, or not calculated.

WASTEWATER TREATMENT FACILITIES DATA

TABLE 27(a)

HUNTINGTON WASTEWATER TREATMENT FACILITY

LOCATION:	Worthington Road, Huntington
RECEIVING WATER:	West Branch Westfield River
NPDES PERMIT NO.:	MA0101265

The Huntington WWTF is a 0.2 MGD facility which utilizes the carousel (oxidation ditch) variation of the extended aeration activated sludge process. The facility currently treats a domestic waste from the central village of Huntington although its design capacity will allow system expansion to cover a much larger portion of the town. Typical of such small oversized plants, the operator complains of such nuisance problems as excessively high aeration basin dissolved oxygen concentrations, old sludge, and difficulties in controlling chlorine dose. Results in mg/l unless noted.

PARAMETER	6/27/90	8/8/90	9/12/90	10/10/90
Flow (MGD)	0.107	0.136	0.112	0.117
BOD	150	11	21	27
pH (Standard Units)	6.7	6.4	6.6	6.7
Total Alkalinity	41	21	21	43
Hardness	39	30	39	31
Suspended Solids	22	14	-	6.5
Total Solids	-	210	242	-
Turbidity (NTU)	4.4	5.6	-	1.1
Total Kjeldahl-N	2.2	3.5	1.9	3.8
Ammonia-Nitrogen	0.04	0.96	0.16	0.43
Nitrate-Nitrogen	6.4	9.0	15	8.7
Total Phosphorus	2.6	3.7	2.6	3.8
Total Coliform/100 ml	-	110,000	-	-
Fecal Coliform/100 ml	6,000	8,100	40	<20
Chloride	36	42	37	34
Iron	0.07	-	0.05	0.04
Manganese	<0.02	-	-	0.011
Aluminum	0.73	-	0.10	0.05
Copper	0.15	-	0.09	0.15
Zinc	0.06	-	0.114	0.04
Lead	<0.002	-	<0.002	<0.002
Chromium	0.002	-	<0.001	<0.001
Cadmium	0.004	-	0.006	<0.001
Nickel	0.003	-	<0.002	<0.002
Silver	<0.001	-	-	<0.001
Mercury	-	-	<0.0002	-

REMARKS

Graphite Furnace
- No measurement taken

TABLE 27(b)

RUSSELL WASTEWATER TREATMENT FACILITY

LOCATION: Grove Street, Russell

RECEIVING WATER: Westfield River

NPDES PERMIT NO: MA0100960

Located just downstream of the Russell Falls Dam, this extended aeration facility is one of the oldest activated sludge secondary treatment facilities in Western Massachusetts.

This facility is being replaced by a new facility near the site. The new facility will be an Innovative Technology Advanced Plant, with Interchannel Clarifier & Oxidation Ditch, 0.1 MGD dry and 0.2 MGD wet weather flow. The plant is expected to be on line by June 15, 1991. The 30 BOD, 30 mg/l solids permit limit is expected to be met. Results in mg/l unless noted.

PARAMETER	6/27/90	8/8/90	9/12/90	10/10/90
Flow (MGD)	0.106	0.139	0.094	0.129
BOD	160	54	42	*
pH (Standard Units)		6.8	6.8	7.07.2
Total Alkalinity	54	49	53	74
Hardness	32	65	32	33
Suspended Solids	2.0	78	-	*
Total Solids	-	270	180	6.6
Turbidity (NTU)	1.3	5.7	-	-
Total Kjeldahl-N	5.4	15	8.8	4.2
Ammonia-N	5.1	10	6.0	0.11
Nitrate-N	0.05	0.37	3.1	0.97
Total Phosphorus	1.0	3.8	1.2	2.1
Fecal Coliform/100 ml	7,000	-	91,000	240
Chloride	33	27	28	-
Iron	<0.03	-	-	0.34
Manganese	<0.02	-	-	0.028
Aluminum	0.61	-	-	0.10
Copper	0.03	-	-	0.28
Zinc	0.07	-	-	0.16
Lead	<0.002	-	-	<0.002
Chromium	<0.001	-	-	0.001
Cadmium	0.008	-	-	<0.001
Nickel	<0.002	-	-	0.030
Silver	<0.001	-	-	<0.001

* Analysis could not be completed.
\- No measurement taken.

TABLE 27(c)

STRATHMORE PAPER COMPANY WASTEWATER TREATMENT FACILITY

LOCATION: Valley View Avenue, Woronoco section of Russell

RECEIVING WATER: Westfield River

NPDES PERMIT NO.: MA0004995

In its Woronoco Mills complex, the Strathmore Paper Company operates what is reputed to be the largest paper mill in Massachusetts. Wastewater from the complex is treated via a chemically enhanced primary sedimentation process, before discharging to the Westfield River. Results in mg/l unless noted.

PARAMETER	6/27/90	8/8/90	9/12/90	10/10/90
Flow (MGD)	2.62	2.72	2.71	2.89
COD				
BOD	600	52	81	*
pH (Standard Unit)	6.6	6.9	7.4	6.7
Total Alkalinity	31	31	55	45
Hardness	61	125	121	179
Suspended Solids	9.5	-	-	*
Total Solids	-	270	400	-
Turbidity (NTU)	11	11	-	4.1
Total Kjeldahl-N	0.46	1.3	3.4	2.1
Ammonia-Nitrogen	<0.02	<0.02	0.12	0.02
Nitrate-Nitrogen	0.09	0.24	1.00	0.22
Total Phosphorus	0.18	0.27	0.25	0.20
Total Coliform/100 ml	-	70,000	-	-
Fecal Coliform/100 ml	<20	2,000	20	-
Chloride	39	36	2	34
Iron	-	-	-	0.11
Manganese	-	-	-	0.017
Aluminum	-	-	-	0.70
Copper	-	-	-	<0.01
Zinc	-	-	-	0.05
Lead	-	-	-	<0.002
Chromium	-	-	-	<0.001
Cadmium	-	-	-	<0.001
Nickel	-	-	-	<0.002
Silver	-	-	-	<0.001

* Analysis could not be completed.
\- No measurement taken.

TABLE 27(d)

WESTFIELD WASTEWATER TREATMENT FACILITY

LOCATION: Neck Road, Westfield

RECEIVING WATER: Westfield River

NPDES PERMIT NO.: MA0101800

This facility receives a mixed domestic/commerical/industrial waste from the City of Westfield. Treatment is accomplished via a mechanically mixed conventional activated sludge treatment system before discharge to the Westfield River. Typical of older urban communities, the facility was subject to significant infiltration/inflow hydraulic overloading. Over the past five years, sewer line rehabilitation in parts of the system have dramatically lowered the I/I problem. In the past, the facility has also been subject to slugs of wastes with unusual pH values. Recent changes in the city's sewer use code have mitigated much of this problem. Results in mg/l unless noted.

PARAMETER	6/27/90	8/8/90	9/12/90	10/10/90
Flow (MGD)	3.14	3.78	3.04	3.34
BOD	240	15	35	47
pH (Standard Units)	7.5	7.5	7.2	7.1
Total Alkalinity	130	114	112	130
Hardness	61	66	53	79
Suspended Solids	5.5	2.5	-	33
Total Solids	-	270	240	-
Turbidity (NTU)	5.0	3.0	-	7.0
Total Kjeldahl-N	27	9.4	13	29
Ammonia-Nitrogen	14	1.22	12	17
Nitrate-Nitrogen	1.57	13	1.15	1.61
Total Phosphorus	2.6	1.4	2.4	3.6
Total Coliform/100 ml	-	84,000	-	-
Fecal Coliform/100 ml	60	110	<10	-
Chloride	59	59	42	48
Iron	-	-	0.13	0.41
Manganese	-	-	0.13	0.04
Aluminum	-	-	0.08	0.22
Copper	-	-	<0.002	0.50
Zinc	-	-	0.055	0.13
Lead	-	-	0.003	0.011
Chromium	-	-	<0.001	0.44
Cadmium	-	-	<0.001	0.04
Nickel	-	-	0.002	0.32
Silver	-	-	<0.0002	0.003

- No measurement taken

TABLE 27(e)

COLUMBIA MANUFACTURING WASTEWATER TREATMENT FACILITY

LOCATION: Cycle Road, Westfield

RECEIVING WATER: Little River

NPDES PERMIT NO.: MA0001571

Columbia Manufacturing is a long standing manufacturer of bicycles (having recently celebrated its centennial anniversary) and other metal products. Wastewater from its metal finishing operations is treated by means of the Lancy System. This involves chemical precipitation of metal hydroxides followed by pH adjustment prior to discharge. The effluent is discharged to the Little River off South Meadow Road. Sludge from the treatment system is dewatered by means of a plate and platten filter press and disposed of in a controlled landfill in upstate New York. All results in mg/l unless noted.

PARAMETER	10/10/90
Flow (MGD)	0.102
BOD	10
pH (Standard Units)	6.3
Total Alkalinity	15
Hardness	11
Suspended Solids	<1.0
Turbidity (NTU)	0.7
Total Kjeldahl-N	0.86
Ammonia-Nitrogen	0.05
Nitrate-Nitrogen	0.59
Total Phosphorus	0.17
Chloride	12
Iron	0.14
Manganese	0.007
Aluminum	<0.05
Copper	0.23
Zinc	0.12
Lead	<0.002
Chromium	0.10
Cadmium	<0.001
Nickel	0.05
Silver	<0.001

TABLE 28(a)

HUNTINGTON WASTEWATER TREATMENT FACILITY

AVERAGE COMPARISON OF LABORATORY RESULTS 1985 AND 1990

(All results in mg/l, unless otherwise noted)

PARAMETER	1985	1990	LIMITS AVG. DAY (Monthly)	LIMITS MAXIMUM Daily
Flow (MGD)	0.106	0.115	-	-
BOD	21	52	30	50
pH (Standard Units)	6.0	6.5	-	-
Total Alkalinity	7.5	32	-	-
Hardness	-	35	-	-
Suspended Solids	21	14	30	50
Total Solids	282	226	-	-
Turbidity (NTU)	-	3.6	-	-
Total Kjeldahl-N	9.8	2.9	-	-
Ammonia-Nitrogen	0.18	0.40	-	-
Nitrate-Nitrogen	17.0	10.0	-	-
Total Phosphorus	15.0	2.3	-	-
Total Coliform/100 ml	150/930	-	-	-
Fecal Coliform/100 ml	<36	34/42	200/100ml	400/100ml
Chloride	27	37	-	-
Iron	0.30	0.04	-	-
Manganese	<0.02	0.02	-	-
Aluminum	0.13	0.29	-	-
Copper	0.12	0.13	-	-
Zinc	0.13	0.07	-	-
Lead	0.04	<0.002	-	-
Chromium	<0.02	<0.002	-	-
Cadmium	<0.02	<0.001	-	-
Nickel	<0.02	0.003	-	-
Silver	<0.02	<0.002	-	-
Mercury	-	<0.0002	-	-

TABLE 28(b)

RUSSELL WASTEWATER TREATMENT FACILITY

AVERAGE COMPARISON OF LABORATORY RESULTS 1985 AND 1990

(All results in mg/l, unless otherwise noted)

PARAMETER	1985	1990	LIMITS AVG. DAY (Monthly)	LIMITS MAXIMUM Daily
Flow (MGD)	0.108	0.140	-	-
BOD	17	85	30	50
pH (Standard Units)	6.7	6.9	-	-
Total Alkalinity	54	51	-	-
Hardness	-	43	-	-
Suspended Solids	32	38	30	50
Total Solids	207	152	-	-
Turbidity (NTU)	-	3.5	-	-
Total Kjeldahl-N	7.0	8.3	-	-
Ammonia-Nitrogen	3.3	5.3	-	-
Nitrate-Nitrogen	0.7	1.1	-	-
Total Phosphorus	2.6	4.0	-	-
Fecal Coliform\100 ml	<36/36	82	200/100ml	400/100ml
Chloride	39	39	-	-
Iron	0.38	0.15	-	-
Manganese	<0.02	0.02	-	-
Aluminum	0.13	0.35	-	-
Copper	0.04	0.16	-	-
Zinc	0.08	0.13	-	-
Lead	<0.04	<0.002	-	-
Chromium	<0.02	<0.001	-	-
Cadmium	<0.02	0.003	-	-
Nickel	-	0.015	-	-
Silver	<0.02	<0.001	-	-

TABLE 28(c)

STRATHMORE PAPER COMPANY WASTEWATER TREATMENT FACILITY

AVERAGE COMPARISON OF LABORATORY RESULTS 1985 AND 1990

(All results in mg/l unless otherwise noted)

PARAMETER	1985	1990	LIMITS (lbs) AVG. DAY (Monthly)	LIMITS (lbs) MAXIMUM Daily
Flow ((MGD)	2.53	2.86	-	-
BOD (lbs/day)	72 (973)	244 (3,754)	1,300	2,050
Total Alkalinity	6.6	6.8	-	-
Hardness	30	41	-	-
Suspended Solids (lbs/day)	24 (340)	9.5 (146)	724	1,448
Total Solids	375	340	-	-
Total Kjeldahl-N	3.5	1.8	-	-
Ammonia-Nitrogen	0.14	0.23	-	-
Nitrate-Nitrogen	0.2	0.39	-	-
Total Phosphorus	0.34	0.33	-	-
Total Coliform/100 ml	430/150	7,000	-	-
Fecal Coliform/100 ml	<36/<36	680	200 count/400 max	
Chloride	63	31	400 max	-
Iron	1.26	0.11	-	-
Manganese	0.08	0.017	-	-
Aluminum	1.6	0.70	-	-
Copper	0.02	<0.01	0.08	-
Zinc	0.06	0.05	-	-
Lead	<0.04	<0.002	0.15	-
Chromium	<0.02	<0.001	-	-
Cadmium	<0.02	<0.001	-	-
Nickel	<0.05	<0.002	-	-
Silver	<0.02	<0.001	-	-

TABLE 28 (d)

COLUMBIA MANUFACTURING WASTEWATER TREATMENT FACILITY

AVERAGE COMPARISON OF LABORATORY RESULTS 1985 AND 1990

(All results in mg/l unless otherwise noted)

PARAMETER	1985	1990	LIMITS AVG. DAY (Monthly)	LIMITS MAXIMUM Daily
Flow (MGD)	0.40	0.046	-	-
BOD	-	10	-	-
pH (Standard Units)	7.4	6.3	-	-
Total Alkalinity	41	15	-	-
Hardness	-	11	-	-
Suspended Solids	6	<1.0	20.	30.
Turbidity (NTU)	-	0.7	-	-
Total Kjeldahl-N	2.1	0.86	-	-
Ammonia-Nitrogen	0.04	0.05	-	-
Nitrate-Nitrogen	1.1	0.59	-	-
Total Phosphorus	0.61	0.17	-	-
Chloride	25	12	-	-
Iron	0.81	0.14	2.00	3.00
Manganese	0.02	0.007	-	-
Aluminum	0.15	<0.05	-	-
Copper	0.04	0.23	-	0.17
Zinc	0.57	0.12	1.50	2.00
Lead	0.04	<0.002	-	-
Chromium	0.21	0.10	0.05	0.10
Cadmium	<0.02	<0.001	-	-
Nickel	0.44	0.05	2.35	3.00
Silver	<0.002	<0.001	-	-

TABLE 28 (e)

WESTFIELD WASTEWATER TREATMENT FACILITY

AVERAGE COMPARISON OF LABORATORY RESULTS 1985 AND 1990

(All results in mg/l unless otherwise noted)

PARAMETER	1985	1990	LIMITS AVG. DAY (Monthly)	LIMITS MAXIMUM Daily
Flow (MGD)	2.61	3.35	-	-
BOD	11.75	84.25	30	50
pH (Standard Units)	7.0	7.3	-	-
Total Alkalinity	103	123	-	-
Hardness	-	65	-	-
Suspended Solids	6.3	13.6	30	50
Total Solids	266	255	-	-
Turbidity (NTU)	-	5.0	-	-
Total Kjeldahl-N	20	19	-	-
Ammonia-Nitrogen	9	11	-	-
Nitrate-Nitrogen	2.9	4.3	-	-
Total Phosphorus	4.5	2.5	-	-
Total Coliform/100 ml	120,000/ 930,000	84,000	-	-
Fecal Coliform/100 ml	450,000/	55	200	400
Chloride	41	52	-	-
Iron	<0.04	0.27	-	-
Manganese	0.04	0.04	-	-
Aluminum	0.13	0.16	-	-
Copper	0.04	0.25	-	-
Zinc	0.07	0.09	-	-
Lead	0.008	<0.04	-	-
Chromium	0.03	0.22	-	-
Cadmium	<0.02	0.02	-	-
Nickel	0.09	0.16	-	-
Silver	<0.50	0.003	-	-
Mercury	-	<0.0002	-	-

WESTFIELD RIVER BASIN, DESCRIPTION OF WATERSHED

The Westfield River Basin covers 517 square miles of west-central Massachusetts and includes portions of Franklin, Hampden, and Berkshire counties. Sparsely populated in the upper reaches, the basin's population is concentrated in the southeastern corner in the municipalities of Agawam, Holyoke, Westfield, and West Springfield.

The Westfield River begins in Savoy at a point over 2,000 feet above mean sea level. Flowing southeast, with ridges rising 500 to 900 feet above the adjacent valleys, the river remains mostly in its natural state, surrounded by second- and third-growth forest cover. Dropping 1,000 feet in the first 14 miles, the river swiftly makes its way to Huntington where it is joined by the Middle and West Branches.

The Middle Branch of the Westfield River begins in the town of Peru and flows 18 miles to join the main branch 27 miles above its mouth. Falling 1,250 feet along its course, the Middle Branch has a drainage area of 52.6 square miles and an average flow of 102 cfs at the United States Geological Survey gage just above its confluence with the main branch.

In Becket, the West Branch of the Westfield River is formed by the confluence of Depot and Yokum Brooks. This branch flows 17.5 miles through Becket, Middlefield and Chester, falling 840 feet before joining the Main Branch in Huntington 25 miles above its mouth. At the United States Geological Survey gage 1.5 miles upstream of its confluence, the West Branch has an average flow of 182 cfs and drains an area of 93.7 square miles.

Below Huntington, the river flows over three dams in succession and the river slope decreases as it approaches the town of Westfield. The Westfield River is joined by the Little River 11 miles above its mouth, just as the river is reaching the floodplain of the Connecticut River. The river deepens and winds its way through Robinson State Park and over one more dam in West Springfield before it joins the Connecticut River. The average flow of the Westfield at its confluence with the Connecticut River is 930 cfs.

Pollution in the Past

The total population residing in the Westfield River Basin during the post-World War II boom years grew from 65,000 in 1950 to 83,500 in 1960. By 1970, it totaled 106,845, with the largest growth occurring along the lower main stem. By the mid-1980's, growth had slowed, but the total was approximately 122,000.

By the late 1960's, hundreds of people, including an overflow of workers from urban areas along the lower Connecticut River Basin to the east, had found jobs in three paper mills located on the main stem, an abrasives manufacturer on the lower West Branch at Chester, another paper mill and a metal-finishing plant on the Little River near Westfield, and a radiator plant on Powder Mill Brook, (a small tributary which enters the main stem at the City of Westfield).

These industries discharged suspended solids, organic wastes, process dyes which discolored the water, chromium, aluminum, zinc, lead and cyanides into the Westfield main stem. In addition, the main stem received untreated municipal wastes discharged directly into the river at Huntington, untreated wastes discharged from combined sewers directly to these waters at Agawam and Westfield, and wastes from an overloaded sewage treatment plant in the Town of Russell.

According to a Massachusetts Division of Water Pollution Control (DWPC) spokesman: "By 1972, the pollution loading placed on the Westfield River's main stem in terms of biochemical oxygen demand (BOD) - a measure of the organic

matter in water which consumes oxygen during biological processes that break it down - was 12,000 pounds per day, or the equivalent of an untreated sewage load produced in one day by a city with a population of 78,000"[1].

"As far back as the 1950's," the spokesman continues, "the state rated the main stem from Huntington to Westfield, and the lower West Branch near Huntington as Class D streams, fit only for commerce and navigation. The main stem from Westfield to the Connecticut River was in an even worse condition: a class U waterway, the equivalent of an open sewer."

"This gross pollution killed fish. Anglers avoided the river. Soon, only trash fish - carp and suckers - were left, and from the City of Westfield down to the Connecticut River, bloodworms - creatures that live without oxygen, indicators of gross pollution - thrived in great numbers. Boating declined and rafts of paper mill sludge floated downstream, degrading the shoreline, offending local residents with the stink of nuisance odors. These conditions were particularly bad along the shores of Robinson State Park at Agawam and Westfield."

"There was still another, serious environmental problem," the spokesman emphasizes. "Fecal coliform bacteria counts - a measure of bacterial pollution from human and animal wastes - posed a health hazard. In 1972, fecal coliform bacteria counts recorded by the DWPC at the City of Westfield reached 430,000 organisms per 100 milliliters (ml). The state water quality standard for this portion of the Westfield River is 200 fecal organisms per 100 ml."

[1] "Information and quotations taken largely out of U.S. EPA, Office of Water Planning and Standards Bulletin Sept.-Oct. 1980 A Water Quality Success Story."

WATER QUALITY ANALYSIS

The timing for the 1990 Westfield River Survey in June - September, conformed with average seasonal low flow conditions on June 27 and September 19 surveys. However, the area was subjected to a heavy rainfall period, prior to and just after, the August 8 survey (see Table 21). Flows of June 27 and September 19 surveys ranged between 114-339 cfs along the gauged portion of the Westfield River main stem, and on August 8, flows ranged from 1630-2340 cfs along the main stem (Table 22). Flows on the special survey date, October 10, seemed to approximate June 27 and September 19 flow levels.

Analysis from data collected, plus comparison with prior year's survey data (particularly the 1985 Westfield River Water Quality Report) indicates that water quality conditions remain largely unchanged from five years ago.

The 1990 conditions essentially meet Class "B" water quality standards, except there continues to be continual fecal coliform problems on the lower portions of the Westfield (from station WF21 river mi. 10.1, to Connecticut River confluence), and fecal coliform problems throughout the basin during high rainfall - runoff periods.

Visual signs throughout the survey period did not indicate eutrophic or mesotrophic conditions anywhere on the Westfield main stem or its tributaries. This includes considerable visual inspection of waters behind the impoundment at the Strathmore Bridge (mile 19.5). No algal blooms were spotted in these waters at any time during the survey period.

<u>Dissolved oxygen levels</u>, (Tables 4, 5; Figure 5) were consistently above the Class "B" standard of 5.0 mg/l throughout the basin areas surveyed. <u>Biochemical oxygen demand</u> (Table 6; Figure 6, 9)) ranged from 2.4-7.2 mg/l on June 27; 2.4-15 mg/l on August 8; and 1.8-4.8 mg/l on September 19. Translated into lbs/day, BOD instream loadings (Table 22), the ranges on June 27 were from 3,047-12,086 lbs/day along the Westfield main stem, 852 lbs/day from the Little River (near the Westfield River confluence); on August 8, the ranges were from 20,646-53,262 lbs/day along the main stem, 4,648 lbs/day from the Little River, and 1,123 lbs/day from Powdermill Brook; on September 12, the ranges were from 1,824-5,759 lbs/day in the main stem, 387 lbs/day from the Little River, and 79 lbs/day from Powdermill Brook. There appears to be especially high BOD loadings following heavy rainfall events and less significant loadings during drier periods. <u>BOD</u> loadings ranged, during the survey period from 7-93.6 lbs/day at the Huntington WWTP from 30.7-215.2 lbs/day at the Russell WWTP, and from 387-5694 lbs/day at the Westfield WWTP [Figure 12; Tables 27(a)-(d)].

<u>Nutrients</u> (e.g., phosphorus, nitrogen) [Tables 7-12], stimulate plant and algal growth under appropriate conditions. No significant visible evidence of this was seen during the survey period. On June 27 <u>total calculated phosphorus instream loadings</u> (from Tables 10, 11, 12, 23) ranged from 60-201 lbs/day along the Westfield mainstem, 20 lbs/day from the Little River, and 3.6 lbs/day from Powdermill Brook; on August 8, it ranged from 699-2,789 lbs/day along the mainstem, and 136 lbs/day in the Little River, and 60.8 lbs/day in Powdermill Brook; on September 12, it ranged from 60-268 lbs/day along the mainstem, and 10.8 lbs/day from the Little River, and 15 lbs/day from Powdermill Brook. Total Phosphorus loadings during the survey period ranged from 1.5-3.8 lbs/day from the Huntington WWTP, 0.90-2.8 lbs/day from the Russell WWTP, and 3.6-71.9 lbs/day from the Westfield WWTP [Tables 27(a)-(d)].

<u>Total Kjeldahl-Nitrogen (TKN) Loadings</u>, [Tables 7-9, 23; Figures 11, 13] June 27, ranged from 279-2,182 lbs/day along the Westfield mainstem, 121 lbs/day from the Little River, and 29 lbs/day from Powdermill Brook; on August 8, it ranged from 5,241-11,955 lbs/day along the Westfield mainstem, 1141 lbs/day from the Little River, and 425 lbs/day from Powdermill Brook; on September 12, it ranged from 593-1320 lbs/day along the Westfield mainstem, 170 lbs/day from the Little River, and 33 lbs/day from Powdermill Brook. TKN loadings during the survey period ranged from 1.1-2.7 lbs/day from the Huntington WWTP, 2.9-11.2 lbs/day

from the Russell WWTP, 9.9-45.6 lbs/day from the Strathmore WWTP, 242-641 lbs/day from the Westfield WWTP [Tables 27(a)-(d)].

Ammonia-Nitrogen Loadings, [Tables 7-9, 23] on June 27, ranged from 51-501 lbs/day along the Westfield mainstem, 15.5 lbs/day from the Little River, and 7.6 lbs/day from Powdermill Brook; on August 8, it ranged from 1,017-1,781 lbs/day along the Westfield mainstem, 58 lbs/day from the Little River, and 6.6 lbs/day from Powdermill Brook; on September 12, it ranged from 133-339 lbs/day along the Westfield mainstem, 17.2 lbs/day from the Little River, and 4.7 lbs/day from Powdermill Brook. Ammonia Nitrogen Loadings [Tables 27(a)-(l)] during the survey period ranged from .03-.27 lbs/day from the Huntington WWTP, .08-7.5 lbs/day from the Russell WWTP, and 31.4-339 lbs/day from the Westfield WWTP [Tables 27(a)-(d)].

Nitrate-Nitrogen Loadings, [Tables 7-9] on June 27, ranged from 381-1,494 lbs/day along the Westfield mainstem, was 214 lbs/day from the Little River, and 68.6 lbs/day from Powdermill Brook; on August 8, ranged 2,982-6,613 lbs/day along the Westfield mainstem, 988 lbs/day from the Little River, and 420 lbs/day from Powdermill Brook; on September 12, ranged 521-1480 lbs/day along the Westfield mainstem, 232 lbs/day from the Little River, and 76 lbs/day from Powdermill Brook. Nitrate-Nitrogen Loadings [Tables 27(a)-(l) during the survey period ranged from 3.8-9.1 lbs/day from the Huntington WWTP, .07-2.3 lbs/day from the Russell WWTP, 1.9-21.9 lbs/day from the Strathmore WWTP, and 32-335 lbs/day from the Westfield WWTP [Tables 27(a)-(d)].

Algal and Chlorophyll a Counts, [Table 20] according to Table 19, are quite low throughout the basin during the survey period.

Suspended Solids Loadings, [Tables 10-12, 23; Figure 14] on June 27, ranged from 3241-15,107 lbs/day on the mainstem of the Westfield River, and 646 lbs/day from the Little River tributary. On August 8, loadings were very high (following heavy rainfall): on June 27, loadings ranged from 89,028-228,930 lbs/day along the Westfield mainstem. Suspended solids loadings during the survey period ranged from 4.3-14 lbs/day from the Huntington WWTP, 2.7-58.3 lbs/day from the Russell WWTP, 205 lbs/day from the Strathmore WWTP, and 659-1701 lbs/day from the Westfield WWTP [Tables 27(a)-(d)]. Chloride Levels [Tables 10-12] ranged between 4-29 mg/l throughout the entire basin survey period. Fecal Coliform Bacteria, [Tables 10, 13; Figure 10] throughout the survey, levels frequently did not meet Massachusetts Water Quality Standards (200 mg/l 100 ml) on the lower portions of the Westfield River mainstem and tributaries (WF 19, 20-25 incl. Little River and Powdermill Brook). Levels on this lower Westfield portion ranged between 60-14,000 during the entire survey period, with an average of 3,165 org./100 ml for all stations and dates surveyed.

On June 27, the levels upstream (Stations WF08-WF14) on the main stem, plus the West Branch, ranged between 60-200 org./100 ml; on August 8, (just following a heavy rain event), levels ranged between 400-14,000 org./100 ml; on September 12 levels ranged between 40-150 org./100 ml; on October 12, the level at WF12 was 600 org./100 ml. During wet weather flow periods, the mid and upper portions of the basin tend not to meet fecal coliform standards. It should be particularly noted that fecal coliform counts at, and just downstream (WF.12) from the Russell WWTP, ranged 80-14,000 org./100 ml (average 3,800). Also, the counts at the Huntington WWTP on June 27 and August 12 were 6,000 and 8,100 org/100 ml, respectively. Additionally, on the high flow day, August 8, Strathmore WWTP had a count of 2000 org./100 ml. Fecal coliform levels at WF08 (near confluence of West Branch with main stem), on West Branch ranged between 40-400 org./100 ml during the entire survey period, (the 400 coming on the 8/08 high flow day). It would definitely appear that there are higher fecal coliform counts following wet weather events.

Metals Concentrations [Tables 14-16A], and loadings [Table 23] are generally within U.S. EPA water quality criteria [Table 16B, Freshwater Metals Criteria for Aquatic Life Protection] for copper, lead, zinc, aluminum, chromium, and cadmium. The only exception is slightly elevated aluminum levels, ranging from 0.05-0.95 mg/l throughout the survey period, (with an average of 0.40 mg/l). Other metals were at, or near, minimum detection limits.

Microtox™ Test Sampling and Results [Tables 17-18] A water quality survey was conducted on the lower portion of the Westfield River on June 27, 1990. Three instream samples were collected for subsequent toxicity analyses using the Microtox™ toxicity analyzer. A brief description of the instream sampling locations is given below:

WF12: Westfield River, off Route 20, Russell
WF22: Westfield River, Frog Hole, Route 20, Westfield
WF25: Westfield River, Route 5 Bridge, West Springfield

Additional sampling information is given in Table 17. Microtox™ results are located in Table 18.

Comments - no acute instream toxicity was detected in the WF12 sample. The 5-minute EC_{50} was 100% sample, and both the 15 and 30-minute EC_{50}s were reported as spurious. Only minor incipient toxicity (5-minute EC_{10} = 52% sample) was detected. Additional information is presented in Figure 1.

The Microtox™ toxicity analysis of the WF22 sample indicated an extremely toxic sample. The EC_{50}s for 5, 15 and 30 minutes were all <5.6% sample. A duplicated Microtox™ analysis also resulted in EC_{50}s <5.6% sample and warrants consideration for additional sampling.

No instream toxicity was detected in the WF25 sample. The 5, 15 and 30-minute EC_{50}s were reported as spurious; the same was true for the EC_{10}s and EC_{20}s.

It was recommended that Microtox™ sampling be conducted at the following stations in an attempt to bracket possible sources of instream toxicity in the Westfield River:

WF12: Westfield River, off Route 20, Russell
WF16: Little River, Horton's Bridge, Westfield
WF19: Little River, off South Meadow Road, Westfield
WF22: Westfield River, Frog Hole, Route 20, Westfield
Westfield River, just above confluence with Little River

On July 11, 1990, six instream grab samples were collected from the Westfield and Little Rivers in order to follow up on the Microtox™ analysis of the sample collected on June 27, 1990 from Station WF22, which indicated an extremely toxic sample. The analysis of WF22 indicated a non-toxic sample, since the 5, 15 and 30-minute EC_{50}s were reported as spurious. The source of toxicity from the previous sample could be attributed to either a transient slug or bottle/sample contamination prior to analysis, but the precise source of toxicity is ambiguous at this point. The remaining five samples were not run due to complications with the Microtox™ analyzer.

On August 8, 1990, four instream grab samples were taken from the Westfield River at Stations WF12, 19, 22, and 25 and were analyzed for toxicity with the Microtox™ on August 9. Additionally, one instream grab sample from Station WF22 and a prechlorinated effluent grab sample from the Westfield WWTP were collected on October 11, 1990. Both of the latter samples were analyzed for toxicity on October 12, 1990.

Additional sampling information can be found in Table 17. Microtox™ results are located in Table 18.

None of the five samples tested from the Westfield River nor the Westfield POTW prechlorinated effluent were found to cause toxicity to the Microtox™ bacterium, Photobacterium phosphoreum. All EC_{10}s, 20s and 50s were either 100% sample or were reported as spurious (i.e.) the samples caused actual increases in light output of the bacteria compared to that of the controls).

Spectrometry Analysis of Purgeable Organics

Three stations WF12, 22, and 25 were sampled [Table 19] June 27, August 8, and September 12. No organics were detected, except at WF12, on 9/12, a methyl ethylketone level of 3.7 µg/l was detected.

Columbia Manufacturing Co. Discharge

In the 1990 update study of water quality conditions in the Westfield River Basin, Columbia Manufacturing Co., of Westfield, a former discharger to the Little River, continues to be of concern as a discharger in the Westfield Basin. Recently, beginning about April 1990, the company tied into the Westfield Sewer System. This is creating concerns at the Westfield Wastewater Treatment Plant: in addition, under the City of Westfield pretreatment program, the Westfield WWTP has just issued additional guidelines/changes to the general conditions of the permit (9/11/90), and has, accordingly, asked the Company to submit a new schedule of compliance, which will incorporate the new guidelines and changes. As of the current date, the compliance schedule had not been received from the Company.

During the summer of 1990, a synoptic survey was conducted in the Westfield River Basin. Eleven stations were sampled, as well as four discharge permittees on June 27, August 8, and September 12. Additional Microtox™ sampling was conducted on August 16; and five discharge permittees (incl. Columbia Manufacturing), along with six river stations (for bacteria) were sampled on October 11.

From the June 27 survey, one of the samples showed extreme toxicity. The water column sample was taken from the Frogs Hole Bridge, (Station WF22), in Westfield, which is roughly 3/4 mile downstream from the confluence of the Little and Westfield Rivers. An additional Microtox™ sample was taken from the same station on August 16, but the test results were negative. Although clear conclusions cannot be drawn from the one toxic sample (Aug. 8), it is possible that a slug of some sort of pollution existed in the river. There are several NPDES permit discharge sources immediately upstream of WF22: five metal finishing/plating companies, of which Columbia Manufacturing, on the Little River, is the largest (by far) discharger; and the (Westfield) WWTP.

Through the assistance of Mr. Alan Pierce, Superintendent at the Westfield WWTP, the following records were made available: sample analysis (metals/organics) of influent and effluent from Westfield WWTP, sludge samples from Westfield WWTP, sample analysis (metals/organics) of Columbia Manufacturing, from combined sewer line leaving the Company, and Columbia's monthly self monitoring report for 1989.

Sampling dates conducted by Westfield WWTP staff included the following: Westfield WWTP - 12/06/89, 6/6/90, 7/17/90 - 7/20/90, 7/31/90-8/1/90, 8/7/90-8/10/90; Westfield WWTP Sludge - 12/4/89, 12/14/89; Columbia Manufacturing Co. - 10/21/89-10/27/89.

The laboratory results, (Tighe & Bond, Inc.), indicates a very highly elevated total chromium level of 14 mg/l in a Columbia composite sample on 10/21/89. Columbia's average daily discharge permit limit for total chromium is 1.50 mg/l, and the max daily is 2.00 mg/l. The 14 mg/l reading on 10/21/89 is clearly a permit violation. In addition, the Columbia composite samples on 10/25/89-10/27/89 are close to violation levels (1.5-2.0 mg/l).

There were no lab tests done on the Westfield WWTP influent or effluent, in or around any of these dates, to verify the existence of elevated total chromium levels. Influent composites 8/7-8/10/90 showed elevated total chromium levels

(0.84-1.5 mg/l), and effluent composites on 7/19-7/20/90 are elevated (1.8 mg/l). Of particular note, from the data, is the very high total cyanide levels (2.6-4.7 mg/l) from raw and final grab samples (6/6/90) at the WWTP.

Mr. Pierce indicated that there are documented chemical and biological process operational problems in the Westfield WWTP that conform to several of the dates where elevated levels of Cr^{tot} and Cn^{tot} were detected in the plant. This has been particularly true since April 1990, when Columbia Manufacturing tied their discharge into the sewer lines. He claims that there have been <u>more</u> instances since April, 1990, where WWTP operating problems have occurred. Mr. Pierce, as well as the pretreatment coordinator at the WWTP think that the discharge from Columbia is the prime source of the difficulties occurring at the plant. A case in point was on October 11, 1990, when plant personnel noted for several hours that the influent color was a dark green color, and that in the subsequent 24-36 hours there were considerable disruptions to normal plant chemical/biological operations. Unfortunately, samples for lab analysis were not taken due to current local budgetary restrictions. However, the city is currently trying to elicit a new contract for lab services which would be much closer, geographically, and costing less than the present contractor arrangement. Hopefully, this would allow for more frequent sampling and analysis, to better document the frequently occurring problems.

Discussion with Mr. Timothy McElroy of the DEP, Western Regional Office, indicated that over the past several years. The office had been actively involved with Columbia Manufacturing. Numerous site visits have been made by the Western DEP Office, with concerns expressed over the treatment processes there, as well as the discharge itself. Specifically, the company has repeatedly dumped metal processing rinse water, without pretreatment, directly into the Little River. Also, there is concern about residuals creating potential hazardous waste problems at the company.

Apparently, DEP's involvement convinced EPA officials in the Region I, and Headquarters Offices, to take a more active role in the overall problems at Columbia Manufacturing. EPA is currently involved in a major litigation case involving the Company.

It is recommended that Westfield WWTP staff continue to monitor influent/effluent at the plant, as well as the sewer line leaving Columbia. Increased funding should be requested from the Westfield, Board of Public Works, specifically for more frequent sampling and lab analysis at the WWTP and Columbia, in order to more closely document the sources of operational problems at the WWTP.

WESTFIELD RIVER

WATER QUALITY CHANGES, COMPARISON WITH 1985 DATA

Tables 23-26; Figures 12-14 represent a compilation of loadings data from the 1985 and 1990 Westfield surveys. Representative flows, with estimated mass loadings, or averaged mass loadings, in each parameter are listed in the tables for the survey dates during those particular years. For the 1985 survey (Table 24) flows and respective loadings are averaged for the two survey dates. In comparing loadings between the two surveys, only two of the three 1990 survey dates are used (6/27, 9/12). The other 1990 survey date, 8/8, consisted of unusually high flows and loadings, which are not comparable to the lower flows and loadings on other survey dates in either the 1985 or 1990 surveys.

Table 23 shows flows, as well as loadings for all parameters on all the 1990 survey dates both for river stations as well as dischargers. Table 24 summarizes flows and existing loadings for the 1985 survey for the same stations and dischargers. Table 25 compares the average mg/l concentrations in the water column at various stations between the 1985 and 1990 surveys. Table 26 summarizes and compares flows and loadings at various stations between the 1985 and 1990 surveys. Tables 27(a)-(e) compares 1985 with 1990 effluent parameter

concentrations (mg/l) of five major dischargers monitored along the Westfield and Little Rivers. Figures 8, 9, and 11 graphically show the comparison between the 1985 and 1990 average concentrations of D.O., BOD_5, TKN in the water column; Figure 10 shows comparison between the 1985 and 1990 surveys with fecal coliform counts; and Figures 12-14 show the comparison of loadings between 1985 and 1990 surveys for BOD_5, TKN, and suspended solids.

The overall comparison would indicate that average water quality conditions throughout the basin have not significantly changed between 1985 and 1990. While numerous variations in water column concentrations and loadings between the two survey years are evidenced, the overall picture in the basin has not really changed in five years. The entire river basin met water quality standards for dissolved oxygen, and all except the lower 5 mile portion met for fecal coliform. It would seem that fecal coliform levels generally have lowered since 1985, except during wet weather flows, e.g., 8/8/90, where there continues to be violations throughout the main stem.

On the main stem between 1985 and 1990 BOD_5 loadings <u>decreased</u> an average of 1% ; ammonia-nitrogen <u>decreased</u> an average of 1%; nitrate-nitrogen <u>increased</u> nearly 45%; TKN <u>decreased</u> 39%; total phosphorus <u>decreased</u> an average of 13%; suspended solids decreased an average of 12%; fecal coliform counts decreased an average of 44%; chloride decreased an average of 13%; iron decreased 11%; aluminum increased 276%; copper decreased 50%; zinc increased 21%; and cadmium and chromium were negligible. The most notable parameter change is the marked increase of aluminum loadings over the five year period, particularly in the WF10-WF14 portion of the river.

As noted already, the above changes are based on days with fairly normal flows (230-343 cfs) along the main stem during the 1985 and 1990 basin studies. However, post wet weather flows (>1" rainfall), present a different story. Fecal coliform counts, plus loadings for the 8/8/90 wet weather day (Table 23) are very high. The average loadings on 8/8/90 for each station along the WF10 - WF25 main stem portion include (with flows ranging from2125-2425 cfs): BOD_5 62,850 lbs/day; Suspended Solids 164,013 lbs/day; TKN 8,470 lbs/day; Ammonia-Nitrogen 1,170 lbs/day; Nitrate-Nitrogen 6,228 lbs/day; Total Phosphorus 1,530 lbs/day; Fecal Coliform count 10,680/100 ml; Aluminum 3,167 lbs/day; Copper 1,013 lbs/day; Zinc 362 lbs/day; Lead 141 lbs/day; Chromium 85 lbs/day; Cadmium <43 lbs/day. The combined 4 major dischargers contribute only a very small portion of these loadings; it is therefore assumed that a combination of other point source dischargers, higher erosion rates, nonpoint sources - storm water runoff during significant rainfall, runoff events triggers the vast increases in all loadings and fecal coliform counts.

<u>Wastewater Treatment Plant Analysis</u>

Tables 27(a)-(e) detail, and Tables 28(a)-(e) summarize all data collected in 1985 and 1990 for 5 major dischargers into the Westfield main stem. Obviously, the greatest problem with four of the dischargers in 1990 is high effluent BOD_5 levels (Huntington WWTP, Russell WWTP, Strathmore Paper Co., and Westfield WWTP). The average BOD_5 level for the four dischargers survey days (6/27, 8/8/, 9/12, 10/10) exceeded the maximum daily allowable level in the permit, (50 mg/l) for municipal WWTP's 2050 lbs/day at Strathmore). All these plants performed well within their average daily BOD_5 permit limit in 1985 (30 mg/l for municipal WWTP's, 1300 lbs/day for Strathmore). However, in 1990 there were quite a few violations of the BOD_5 limit. Huntington was in violation on 6/27; Russell on 6/27, 8/8; Strathmore on 6/27, 9/12; and Westfield on 6/27. With respect to total suspended solids, all the plants generally met daily average limits, except for the Russell WWTP.

All plants generally met Fecal Coliform count limits. Total Phosphorus levels seemed fairly low at all the plants (2.3-4.0 mg/l). Phosphorus loadings ranged from 1.5-3.8 lbs/day at Huntington WWTP, 0.90-2.8 lbs/day at Russell WWTP, and

36-72 lbs/day at the Westfield WWTP. Nitrogen levels (TKN; Ammonia-N; Nitrogen-N), at both the Huntington and the Westfield WWTPs saw improvements since 1985, however, the Russell WWTP witnessed higher levels in 1990. Metals concentrations were not significant, except for the problems reported earlier in regards to Columbia Manufacturing tie-in to the Westfield WWTP.

In addition to the five dischargers sampled during the 1990 Westfield River Survey, there are at least 13 other permitted dischargers along the mainstem and Little River Tributary. Four of these dischargers are paper companies, four are metal finishing companies, two are hospitals, and three are public entities. Along with the earlier described problems at Columbia Manufacturing Co., there have been reported violations at the Westfield River Paper Co. plant upstream in Russell. Additionally, Strathmore Paper Co. has requested in a recent renewal permit application, that it be allowed a 20% increase in its daily BOD_5 limit (from 1300 lbs/day to 1560 lbs/day).

It should be noted that with the new advanced WWTP coming on-line in Russell by June 1991, the water quality downstream will be enhanced somewhat. This should create an improvement (i.e. lowering) of at least 5% in BOD_5, nutrient, and solids loadings in the river just downstream from the discharge.

THE BEGINNINGS OF LOCAL, STATE, AND FEDERAL PARTNERSHIP

As with all other water quality improvement successes achieved along specific American waterways, cleaning up the Westfield River didn't happen by itself. It took the combined efforts of the Massachusetts DWPC, which set water quality standards, issued permits to municipal and industrial dischargers, and monitored improvements along these waters - and the federal U.S. Environmental Protection Agency (EPA), which awarded funds to construct sewage treatment plants, awarded other funds to study and clean up pollution from nonpoint sources, and issued discharge permits concurrently with the state.

Over and above these state and federal actions, however, the dedicated activist efforts of the Westfield River Watershed Association provided the impetus to restore this scenic and highly utilized river.

By the mid-1960's, the Westfield River Watershed Association had formed a powerful and increasingly vocal coalition of private citizens, local civic leaders, pro-environmental industrial representatives, and political and legislative leaders at the highest state level. As the 1960's passed into the 1970's, and as the ripple effect of the Association's environmental activism merged into a nationwide ground swell, other citizen groups around the country also fought to restore America's waterways.

Their efforts, and those of others around the country, were repaid on October 1, 1972, when Congress passed the Federal Water Pollution Control Act Amendments of 1972 which overhauled previous water quality legislation and began the most comprehensive program of water pollution control in the nation's history by mandating a sweeping federal and state effort to clean up the country's rivers and lakes.

State and Federal Cleanup Actions

Acting under the authority of Section 201 of the landmark Federal 1972 Water Act, the Massachusetts DWPC and the Westfield River Watershed Association conducted public hearings to determine the type of waste treatment facilities needed by several towns and cities along the Westfield River, and to make the local public aware of available funding.

Shortly after, these communities hired engineering consultants to draw up pollution abatement plans for state approval. Local hearings were then held to vote approval of final state-approved water pollution abatement plans.

Before the 1972 Water Act was passed, the Federal Water Pollution Control Administration (FWPCA), the predecessor agency to the EPA, had awarded the City of Westfield $2.3 million in 1970 to construct a conventional activated sludge secondary treatment plant. Later, between 1977 and 1979, the EPA awarded the city an additional $257,000 to construct pipelines to separate stormwater and sanitary discharges to the treatment plant. On line in 1973, the City of Westfield's secondary treatment facility provides treatment for 4.0 million gallons per day of the city's municipal and industrial wastes, and removes 85 to 90 percent of the BOD and suspended solids in its discharges.

In 1970, the FWPCA awarded the Town of West Springfield $418,000 to construct an interceptor sewer system and a force main. In 1971, the EPA awarded the town $2.9 million to construct an additional interceptor sewer system and force main, and a pumping station. All of these facilities were tied in to the town's treatment plant and made operational by 1973. Finally, in 1979, the EPA awarded West Springfield $2.1 million to construct pipelines to separate stormwater and sanitary discharges to the waste treatment plant. These additional facilities were put on line in the early 1980's and additional CSO planning work was supposed to commence by 1990.

In 1973, the EPA awarded the City of Springfield $39 million to upgrade its primary treatment plant to secondary status, and also construct a sewer interceptor system. Known as the Bondi Island Regional Treatment Plant, this conventional secondary facility - on line in 1977 - provides treatment for 67 million gallons per day of municipal and industrial wastes, removes 96 percent of the BOD and 94 percent of the suspended solids in its discharges, and serves the communities of Springfield, West Springfield, Agawam, Longmeadow, East Longmeadow and Ludlow.

In addition, in 1975 and 1977, the EPA awarded the City of Agawam a total of $2 million to construct interceptor sewer systems, pumping stations, and force mains. All of these ancillary waste treatment facilities were tied into the Bondi Island Plant and were operational by the end of 1979.

Finally, in mid-1977 the EPA awarded the Town of Huntington $970,000 to construct an activated sludge secondary treatment plant with extended aeration. On line in 1978, this new plant provides treatment for 0.2 million gallons per day of municipal wastes, and removes 85 percent of the BOD and suspended solids in its discharges.

Section 402 of the Federal 1972 Water Act established the National Pollutant Discharge Elimination System (NPDES). Implemented by the EPA and the states, this system defines the requirements for permits to discharge into the nation's waters.

Acting under this authority, the DWPC identified each industrial polluter along the Westfield and recommended appropriate cleanup actions.

Acting under the authority of Section 402, between 1974 and 1976 the EPA and the DWPC issued the first discharge permits under the NPDES program to seven major industrial and two major municipal dischargers, and to four minor industrial and three minor municipal dischargers along the Westfield River.

Industry responded, as three of the four paper mills along the main stem constructed in-house facilities to treat their wastewater before discharging to the river. The fourth paper mill constructed storage lagoons to settle suspended solids, neutralization facilities to remove dye wastes, and recycling equipment to treat process wastes with no direct discharge to the Westfield River.

In addition, the abrasives manufacturer constructed equipment to recycle its wastes with no direct discharge to the river, the metal-finishing plant constructed an in-house metals removal facility, and the radiator plant provided phosphorus removal equipment.

The 1980's saw a construction grant awarded to the Town of Russell to build a new secondary plant. Construction began in 1988 and was expected to be complete by 1990. The Division continued periodic monitoring of the Huntington and Westfield Municipal Plants, as well as the industrial permittees.

Restored Water Uses Along the Westfield River

As a direct result of combined regional, state and federal cleanup actions, monitoring studies conducted by the Massachusetts DWPC along the Westfield River main stem during the late 1970's showed that water quality had improved markedly over a few short years.

By 1978, the overall BOD loading in these waters had dropped from the 12,000 pounds per day load recorded in 1972 to 4000 pounds per day in 1978. This is an impressive 66 percent reduction achieved between 1972 and 1978. Loadings in 1985 averaged about 4000 pounds per day, and the 1990 survey averaged about 3900 pounds per day.

Moreover, DWPC monitoring studies conducted in 1978 at the City of Westfield indicated a fecal coliform bacteria count of only 160 organisms per 100 ml, a

remarkable 99.6 percent reduction of bacterial pollution from the 430,000 organism per 100 ml count recorded at the same location only six years before. "This tremendous improvement is indicative of fecal coliform reductions achieved along the entire main stem by 1978," the DWPC spokesman emphasized.

With water quality visibly improving along this New England stream, fish kills became a thing of the past and bloodworms no longer infested the lower main stem. Encouraged by the return of sportfish to these waters, anglers returned to the main stem to haul in sizeable catches of smallmouth bass, and rainbow and brown trout, which the Massachusetts Division of Fisheries and Wildlife began restocking along this segment in 1977. Boaters, canoers, and kayak enthusiasts also appeared in large numbers, as water quality conditions no longer offended local residents or degraded the appearance of the shoreline.

Robinson State Park, with its hiking and bicycle trains, is also a haven for swimmers and picnickers. While nuisance odors from paper mill sludge no longer plague visitors, there are sporadic coliform problems from nonpoint source pollution in the City of Westfield. "We are addressing this situation," says the Lower Pioneer Valley Regional Planning Commission, "and anticipate renewed swimming and fishing in and along the park in the near future."

The Westfield River Meeting Water Quality Standards

Back in 1966, the Massachusetts Legislature had enacted Section 27, Chapter 21, General Laws of Massachusetts. Known as the Massachusetts Clean Waters Act, this legislation: "Adopts standards of water quality which shall be applicable to the various waters, or portions of waters, of the Commonwealth."

Under this authority, in 1967 the DWPC developed water quality standards, including classifications, for all of Massachusetts' waterways. The DWPC then classified the Westfield River as a Class B waterway (See Figure 3) - suitable for water contact recreation, an excellent fish and wildlife habitat, and acceptable for public water supply after treatment and disinfection - and mandated that this quality standard be achieved along the entire Westfield River.

The following segment-by-segment review of the Westfield River conducted by the DWPC in 1978, and again in 1980, 1985, and 1990 indicates how water quality had improved in terms of conventional pollutant cleanup.

- Main Stem

  In 1978, the main stem was no longer degraded by paper mill wastes. During that year, the main stem from Huntington to the City of Westfield achieved Class B status. From the City of Westfield to its mouth at the Connecticut River, the main stem achieved Class C status, suitable for recreational boating and secondary water contact recreation and for certain agricultural and industrial uses. A Class C waterway is also a suitable habitat for fish and wildlife indigenous to the region. By 1990, only the last 8 miles from Agawam to the Connecticut River confluence remained at Class C status.

  "In 1980," says the DWPC, "seventy five percent of the main stem qualifies as a Class B waterway. The main bottleneck in 1978 had been combined sewers which discharged untreated wastes into the river at the City of Westfield. Since then, most of these combined sewers have been tied in to the local treatment plant." By 1990 this percentage increased slightly to 80%.

- East Branch

In 1978, through 1990, the East Branch was a Class B waterway.

- Middle Branch

In 1978, and in 1980, the Middle Branch maintained Class A status above the Littleville Dam, and a Class B rating below this location. Class A waters are designated for use as sources of public water supply, and are severely restricted for recreational use.

- West Branch

In 1978, and 1985, the West Branch achieved Class B status above the Town of Chester, but due to septic tank malfunctions which caused minor fecal coliform problems below Chester, a Class C rating below Chester.

In 1980, in spite of sporadic coliform violations, the entire West Branch is classified as a Class B waterway. Only one station was sampled in 1990, which was just upstream from the Huntington WWTP. This generally met the Class B standard for coliform and dissolved oxygen.

- Little River

In 1978, the Little River from its source to the Cobble Mountain Reservoir achieved Class A status, and a Class C rating from the reservoir to its mouth on the Westfield River.

In 1978, the last two river miles above the confluence with the Westfield River were experiencing fecal coliform bacteria violations from combined sewer overflows. In 1980, these overflows were eliminated and this segment has fully met Class B standards in the 1985 and 1990 surveys.

Water Quality samples were collected from the Westfield River by the Technical Services Branch during the spring and summer of 1985 and summer of 1990. Table 3 summarizes by river segment, the use classification, status, and problems from analysis of 1985 results. Table 4 gives dissolved oxygen results from 1990 survey. High concentrations of dissolved oxygen were maintained throughout the river. Values in the 1985 and 1990 surveys were mostly 8.0 mg/l or above on the main stem and tributaries of the Westfield River. All samples exceeded the Class B water quality standard for dissolved oxygen.

Figure 4 shows the fecal coliform data for stations sampled on the Westfield River in 1985. Figure 7 shows this data for stations sampled in 1990 survey. There were a number of violations of the fecal coliform standard of 200 organisms per 100 ml in both 1985 and 1990. The bacteria standard was violated more frequently and by a greater amount at the downstream stations, which are located in Westfield and Agawam and West Springfield. High bacteria concentrations were caused by urban runoff, combined sewer overflows (CSOs), and dry weather overflows in the two communities. The 1990 data indicated higher fecal coliform counts just after significant wet weather throughout the middle and lower portion of the Basin, such that Class B standards are not met for vast portions of the Basin. DEP, Construction Grants-funded activities have been occurring in these two communities which has resulted in some improvement in water quality in the lower portion of the Westfield River. The City of Westfield has already completed a sewer system rehabilitation project. Agawam has participated in a study of CSOs in seven (7) communities which discharge to the Connecticut River and its major tributaries. This study developed abatement strategies for CSOs.

Additionally, a CSO pump station has been constructed in Agawam. There has been slight improvement between 1985 and 1990 in fecal coliform counts in the lower portion of the Westfield, however, much of this still does not meet Class B standards.

Plots of data of concentrations of BOD_5, suspended solids, ammonia-nitrogen, and total-phosphorus collected in the 1985 and 1990 surveys [Figure 8-14] showed similar trends. Pollutant concentrations were lower in the uppermost reaches of the river, reflecting very good water quality. Pollutant concentrations increased at the downstream stations, due to greater pollutant loadings from the drainage basin. The number of wastewater treatment facilities and the size of these plants increased in downstream communities, where the watershed has higher populations. In the middle portion of the river, water quality problems were caused by failing on-site disposal systems and untreated discharges.

The trends of data between 1985 and 1990 in Figures 8-14 demonstrate only a very slight improvement, if any, in overall conditions. BOD and D.O. chemistries are about the same. Fecal coliform counts are lower in the Lower Westfield portion. TKN is slightly lower in 1990 throughout the basin. BOD loadings were about the same, NH_3-N loadings were somewhat less, and suspended solids loadings were about the same.

The most significant conclusions remained that the very lower portion of the Westfield River (Agawam, West Springfield) did not meet Class B water quality standards for fecal coliform. Several people encountered during the 1990 survey (as well as the 1985 survey) complained about the lack of primary recreation opportunities, and the poor aesthetic quality of the water. On these scores, there has not been much change over five years.

RECOMMENDATIONS

There appears to be at least some problems with a number of larger permittees with meeting their BOD permit limits, plus at least one example of inadequate pretreatment into a municipal WWTP. Since the Department will be embarking on increased efforts in permit compliance, water quality in the Westfield River mainstem would be enhanced with future DEP compliance activity in that basin during 1991-1992. Special attention should be given to the Huntington, Russell, and Westfield WWTP's, as well as Strathmore Co., Westfield Paper Co., (Russell), and Columbia Manufacturing Co., (Westfield). Additionally, DMR's of the other twelve permittees should be examined, with compliance contact checks made, as appropriate.

It is recommended that Strathmore Co. not be granted its request for a 20% increase in BOD_5 loadings. They already contribute, with an average permit BOD limit of 1050 lbs/day, one-third of the existing BOD_5 load to the river at that point. A recent re-study of their wasteload allocation would indicate that granting the Strathmore request to increase the loading to 1300 lbs/day, would result in serious pollution problems downstream when the flow is at or near 7Q10 low flow conditions.

As for the West Branch Tributary, 1990 results at WF08 would indicate a continuation of significant BOD_5 and nitrogen loadings in that portion of the river basin. This particular synoptic study did not get into detailed sampling and analysis of the entire West Branch and its problems. The 1985 report did indicate possible discharge as well as nonpoint source problems in the Chester portion of the West Branch. The Chester, and surrounding areas, should consider the Department's Non-Point Source Best Management Practices Program, for possibly funding a non-point source control project in the region.

The land use along the Westfield River from the Westfield River town line to the Connecticut River Confluence is essentially urban. In 1985, the portion from WF14 to WF25, (river mile 17.3 to 0.4), showed consistent violations of Fecal Coliform counts (Table 25), whereas in 1990, only the WF23-WF25 (river mile 7.6 to 0.4) portion nearest the confluence showed violations, (except for violations all along the mainstem portion during wet weather). Between 1985 and 1990 nutrient parameters on the lower portion (WF14 - WF25) remained essentially the same.

The 1985 report suggested that both dry and wet weather combined sewer overflows, in the river mile 17.3 to 0.4 portion of the Westfield, were principal contributors to fecal coliform, and nutrient loadings in this portion of the river. Agawam has a major CSO project in the Step III phase of construction, which is a forced pump station which will help to alleviate overflows in that area. As of this writing, West Springfield has no such plans which have advanced to this stage. It is highly recommended that special priority be given to fund at least the Phase I and II parts of a CSO plan of study for the West Springfield portion of the Westfield. CSO Construction is needed, which will alleviate fecal coliform counts and nutrient loadings in the last three miles of the Lower Westfield River.

It is highly recommended that the Bureau of Municipal Facilities give strong consideration for future CSO proposals on the Lower Westfield, including the use of planning monies, if available, for the communities of Agawam and West Springfield. Additionally, compliance work should be a top priority at the bigger NPDES facilities: Westfield WWTP, Columbia Manufacturing, Strathmore Paper Co., and Westfield Paper Co.